CHAPTER 3

AFFECTED ENVIRONMENT

Mattie Canyon near the confluence of Cienega Creek.

CHAPTER 3
AFFECTED ENVIRONMENT

INTRODUCTION

Chapter 3 describes the Empire-Cienega Planning Area's physical, biological, social, and economic characteristics that would be affected by implementing any of the alternatives described in Chapter 2. This description is a baseline for analyzing and determining impacts of the alternatives.

SETTING

The Empire-Cienega Planning Area is a unique, scenic area of rolling desert grasslands and woodlands in a high-desert basin between the Santa Rita and Whetstone Mountains. Located along a scenic highway within an hour of the rapidly growing Tucson metropolitan area, the planning area offers outstanding dispersed recreation opportunities but is also highly vulnerable to the impacts of growth. In addition to Tucson, the planning area is readily accessible from the nearby towns of Sonoita, Patagonia, Benson, and Sierra Vista. Access into the area is provided by dirt roads connecting with State Highways 82 and 83.

The planning area encompasses most of a critical watershed that is important to Tucson for flood control and aquifer recharge. The area also includes five of the rarest habitat types in the American Southwest: cienegas, cottonwood-willow riparian areas, sacaton grasslands, mesquite bosques, and semidesert grasslands. In addition, the planning area contains habitat for several endangered species, a site on the National Register of Historic Places, two proposed wild and scenic river segments, and scenic open space.

The planning area encompasses 266 mi^2 (170,558 acres) in southeast Arizona roughly bounded by Interstate 10 on the north, Arizona State Highway 83 on the west, the Whetstone Mountains on the east, and the Canelo Hills on the south (See Map ~~1-4~~ **1-2**). Table 3-1 summarizes the acres by ownership within the planning area.

Table 3-1
Land Ownership: Empire-Cienega Planning Area

Land Ownership	Acres	Percentage
BLM	48,956	28.7
State of Arizona	80,706	47.3
Private	40,896	24.0
TOTAL:	**170,558**	**100.0**

PHYSICAL RESOURCES AND PROCESSES

AIR RESOURCES

Under the National Ambient Air Quality Standards (NAAQS), the air quality rating for the BLM-administered lands within the Empire-Cienega Planning Area is Class II. No Class I areas fall within or are contiguous with the planning area. In cooperation with the National Park Service and the National Forest Service, Arizona has established the Interagency Monitoring of Protected Visual Environments Program (IMPROVE), which is monitoring all but two of the 12 Class I airsheds in the state for changes in visibility. Two airsheds relatively

near Sonoita are among the 12: Saguaro National Park and Chiricahua National Monument. But the Saguaro National Park monitoring is on the west side of Tucson, and the Chiricahua National Monument monitoring has not been in place long enough to detect any trends in visibility.

Even without this trend data one can reasonably extrapolate the general air quality of the planning area. None of the county and city monitoring sites in Pima and Santa Cruz counties exceeded standards in 1996 or 1997 (the latest published data). Pollutants measured and within standards included the following:

- Carbon monoxide (1- and 8-hour averages at four sites in Tucson only); lead (quarterly averages at two Tucson sites and one Nogales site).

- Ozone (1-hour average at Saguaro National Park East and five Tucson sites, including Houghton Road near Interstate 10, the nearest site to the planning area).

- Nitrogen dioxide (annual average at only one site in Tucson).

- PM^{10} (inhalable particulate matter) (24-hour average at 17 Tucson sites, including two on South Houghton Road and one in Nogales).

Neither the nine Pima County sites (including the site at South Houghton Road and Interstate 10) nor the one Santa Cruz County site exceeded the 98th percentile standard for $PM^{2.5}$ (fine particulate matter). Although none of the readings can be assumed to apply beyond their sites' immediate vicinities, one can reasonably assume that no sources in the Sonoita Valley are likely to produce higher readings under similar conditions. Air quality in the Sonoita Valley is good and in full attainment with the Clean Air Act and existing air quality standards. No restrictions have been placed on or are foreseen for discharges due to existing air quality.

GEOLOGY

The Empire-Cienega Planning Area lies within the Basin and Range physiographic province, a region of north-trending mountain ranges separated by wide basins. The area is mainly within the Cienega Basin, which is bordered on four sides by fault-block mountain ranges: the Santa Rita Mountains to the west, Empire Mountains to the north, Whetstone Mountains to the east, and Canelo Hills to the south. These mountains consist of Paleozoic marine sediments and Mesozoic sedimentary and volcanic rocks intruded by Laramide-age granitic intrusive rock. The Cienega Basin is filled with alluvial material eroded and transported from these surrounding mountains. The alluvium overlies sedimentary rocks of the Cretaceous Bisbee Group. Its maximum thickness is around 1,000 feet as extrapolated from drill hole data.

SOIL RESOURCES

The properties of the soils vary widely because of the following:

- Environmental conditions under which soils were formed.

- Parent material from which they were formed.

- Current environmental conditions.

The dominant soils are Orthents, Argids, and Fluvents, which have a thermic temperature regime and mostly an aridic moisture regime. Shallow Torriorthents (Cellar, House Mountain, Lampshire, Mabray, and Tidwell series) and

Haplustolls (Faraway and Tortugas series) are found in areas of rock outcrop in the planning area's hills and mountains. In the valleys, Haplargids (White House, Bernardino, Sonoita, and Caralampi series) and Torrifluvents (Gila, Glendale, Anthony, Pima, Grabe, and Comoro series) are dominant.

Soils are described in detail in the two soil surveys covering the planning area:

AZ 667 - Santa Cruz County, and parts of Cochise and Pima Counties (Richardson et al. 1979)

AZ 669 - Eastern Pima County - Unpublished (NRCS 1993)

The deep clay and loamy soils immediately next to portions of Cienega Creek and some of the major tributaries are highly susceptible to gully erosion and soil piping. One such area, Lower Wood Canyon, has severe gully erosion and piping on more than 200 acres. Several areas have large active gullies and deep holes resulting from continuing soil movement. In 1993, a large flood (>100-year flood) scoured Cienega Creek creating a five-foot-deep headcut south of Spring Water Canyon. This headcut was stabilized in 1994. Monitoring results show that this erosion has ceased and the site is healing.

WATER RESOURCES

Precipitation and Climate

The variability of rainfall in the planning area is extreme. Precipitation varies from a high of more than 25 inches per year in the Santa Rita Mountains to a low of 15 inches in the lower valley locations. About 65% of the moisture occurs as summer thunderstorms (Sellers and Hill 1974). These monsoon rains usually begin in July and continue into September. The spring months (April, May, and June) and fall months (October and November) are normally dry. Summer temperatures may reach as high as 100°F but are generally lower. Minimum winter temperatures occur in January and can be expected to fall below 29°F.

Table 3-1a shows annual rainfall totals (for each calendar year) for the Agricultural Research Service (ARS) gage and the Remote Automated Weather Station (RAWS) gage located within the Empire Ranch. The annual rainfall is highly variable at both gages and a "normal" year is seldom encountered. Both gages are about 3 miles apart and the mean and standard deviation for both gages are similar. The mean rainfall is slightly higher at the ARS gage, as expected, since the location is slightly higher in elevation than the RAWS gage. Also notable is that the annual rainfall received by each gage can be considerably different in a given year. For example, the ARS gage recorded less than 9 inches in 1989 while the RAWS gage recorded over 15 inches during the same period. This is due to the fact that most summer moisture occurs in the form of sudden thunderstorms. These storms are highly localized and may drench one area but miss another entirely.

In addition, seasonal rainfall is also highly variable in the region. Above average rainfall may occur during the winter period (November through March) with below average rainfall in the summer period (June through September) or vice versa. During the period 1900 through 1998, seasonal precipitation (either winter or summer, but not both) was above average in 51 out of 99 years (Wilson, et al. 2001).

Table 3-1a
Summary of Precipitation Data
Las Cienegas NCA

Calendar Year	Precipitation (inches) Empire ARS Gage Elev. = 4860 ft.	Precipitation (inches) Empire RAWS Elev. = 4600 ft.
1988	16.16	No data
1989	8.51	15.24
1990	12.93	18.80
1991	13.35	14.26
1992	20.15	20.59
1993	19.98	17.01
1994	17.15	8.59
1995	13.87	10.43
1996	11.20	9.23
1997	14.10	9.98
1998	24.50	16.08
1999	13.45	12.52
2000	22.80	21.47
2001	14.40	16.35
Average	**15.90**	**14.65**
Std. Dev.	**4.52**	**4.28**
Maximum	**20.15**	**21.47**
Minimum	**8.51**	**8.59**

Watersheds

The public lands in the planning area are located in two basins: the Cienega Creek basin and the Babocomari River basin (Map 3-1). Cienega Creek begins in the Canelo Hills at Papago Spring and runs northward to Pantano Wash, a tributary to the Rillito River in Tucson. The basin area is 228.2 mi² (146,038 acres). Table 3-2 summarizes the acres by ownership within the Upper CienegaCreek watershed. Table 3-3 shows major Cienega Creek tributaries that drain from the Santa Rita, Whetstone, and Empire Mountains. The upper basin ends at a geologic constriction known as the Narrows.

Public lands south of State Highway 82 on the Appleton-Whittell Research Ranch and the Rose Tree Ranch are at the headwaters of the Babocomari River drainage and include portions of Post and O'Donnell canyons.

Between 1974 and 1999 BLM and the University of Arizona collected watershed data that show that the planning area's watersheds are in satisfactory condition with adequate cover and a stable trend (Table 3-4). Overall, the watersheds exhibit a low susceptibility to erosion due to the high amount of coarse fragments in the surface and the existing vegetation cover.

Past activity has altered soil and water resources. The segment of Cienega Creek next to the Cienega Ranch was altered for farming in the 1970s. A drag line dug a canal to divert large flood flows around the Cienega Creek bottomlands that were cultivated. This canal bisected a marsh, draining a large portion of its surface water. Today, this marsh exists as an altered remnant near the Cienega Ranch. Over the years the unlined canal has eroded leaving 20-foot-high banks in some places. Below a concrete ford that serves as a control to channel adjustment, the canal has widened to more than 100 feet and deepened to more than 20 feet.

Map 3-1
Upper Cienega Creek Watershed and Perennial Streams in the Watershed

Table 3-2
Land Ownership, Upper Cienega Creek Watershed

Ownership	Acres	Square Miles	% of Total
BLM	40,165.7	62.8	27.5
USDA Forest Service	42,667.1	66.7	29.2
State	39,595.7	61.9	27.1
Private	23,610.2	36.9	16.2
TOTAL:	**146,038.7**	**228.2**	**100.0**

Table 3-3
Major Tributaries of Cienega Creek

Source	Tributaries
Santa Rita Mountains	Gardner Canyon, Empire Gulch, Oak Tree Canyon, North Canyon
Empire Mountains	Fortynine Wash, Stevens Canyon, Sanford Canyon, Pump Canyon
Whetstone Mountains	Mud Spring Canyon, Spring Water Canyon, Mattie Canyon, Wood Canyon, Fresno Canyon, Apache Canyon.

Table 3-4
Summary of Watershed Condition Data, Empire-Cienega Planning Area, Average Values

Source	UA[1]–1974	BLM–1989	UA–1991	BLM–1995	BLM–1997	BLM–1999
% Bare Ground	17	21	20	28	33	28
% Gravel/Rock	34	24	23	28	25	22
% Vegetation	49	55	57	44	42	50
Rating	S[2]	S	S	S	S	S

[1] UA = University of Arizona
[2] S= Satisfactory condition which is based on 35% or less bare ground and the absence of active erosional features.

More erosion is evident with each large flood. Where the canal diversion begins, deposition began to fill the now intermittent Cienega Creek channel and scouring deepened the canal, diverting into it base flows of Cienega Creek.

Also during the 1970s, three dikes were installed next to the farmed bottomlands for pumping irrigation water. These dikes backed up water, but have largely filled with sediment over the years. Normal hydrologic function was restored in 1998 along this 1.4-mile segment of Cienega Creek, which had been modified for agriculture. The dikes have been removed, the levee breeched, and the canal blocked (Simms 2000).

Mattie Canyon was modified drastically as a result of the agricultural diversion in the 1970s. The canal diverted flood flows for the Cienega Creek watershed into Mattie Canyon causing the canyon to adjust vertically and laterally to accommodate the added water and sediment load. Mattie Canyon had a gully plug that stopped a head cut of more than 20 vertical feet, thus protecting the rest of its watershed from the spread of this erosion. The gully plug was lost during a major flood in the fall of 2000.

Groundwater

The Cienega Creek aquifer consists of tight thin layers of sand alternating with lenses of silt and clay. This area of strata lies at depths to 350 feet. Most wells lie in this upper aquifer. Below 350 feet the layers of sand and silt/clay are subject to pressure from the aquifer below. This pressure causes the lower aquifer to "leak" providing an upward transfer of water (Nuzman 1970). Depth to bedrock ranges from less than three feet to more than 5,000 feet, and water reaches the surface when the depth to bedrock is less than 2,300 feet (Knight 1996).

Mountain front recharge and depth to bedrock ultimately control stream discharge in the Cienega Creek basin. An alluvial trough in the upper basin appears to divert ground water into the San Pedro basin (about 40% of the available subsurface flow). Part of the aquifer lies underneath the Babocomari River and Sonoita Creek basins (Knight 1996; Naeser and St. John 1996). Total ground water outflow from the upper basin (236.5 mi^2) has been estimated at 7,261 acre-feet (Knight 1996).

Recharge is considered to be almost entirely from mountain front sources and accounts for roughly 6-7% of annual precipitation. The thick soil in the larger valley does not permit much infiltration into the aquifer, but stores water in the soil column where it either evaporates or is transpired by vegetation. The main input of recharge to Cienega Creek is thought to be either Gardner Canyon in the Santa Rita Mountains to the west or the Whetstone Mountains to the east (Huth 1996; Naeser and St. John 1996). The recoverable ground water is estimated to be 5.1 million acre-feet over a 457 mi^2 area (upper and lower basins) (Naeser and St. John 1996).

Water for domestic and agricultural use is limited in the basin, and these uses rely on groundwater supplied by the Cienega Creek aquifer (Bota 1996). Both the towns of Sonoita (population 707 in 1995) and Elgin (population 223 in 1995) overlie the Cienega Creek aquifer. The upper end of the basin, however, appears to grade into the Babocomari drainage to the east. The groundwater supply for the Sonoita-Elgin area is estimated to be 1.2 million acre-feet (Naeser and St. John 1996). But consumption of more than the amount added to the aquifer annually through inflow and recharge–the amount known as safe yield–would eventually.

result in loss of surface flow in Cienega Creek and a loss of the riparian vegetation and other resources.

Naeser and St. John (1996) estimated the safe yield for the Sonoita area and the Upper Cienega Creek basin (excluding the Babocomari portion of the basin in which Elgin is located) to be 3,980 acre-feet per year--the amount of groundwater recharge. Since 2,663 acre-feet are already being used each year, only 1,317 acre-feet per year of use remain within safe yield. Therefore, the safe yield population density may be calculated at 2,767 people if each person consumes 151 gallons a day.

Sonoita is growing rapidly. Current zoning of one residence for every 4.13 acres would result in a population of about 8,200 when the area is fully built out. The resulting water consumption would be 8,092 acre-feet/year, well above the safe yield (Naeser and St. John 1996).

The Upper CienegaCreek watershed has been estimated to provide 10% (6,200 acre-feet) of the recharge to the Tucson Active Management Area (AMA). In addition, the maintenance of this undeveloped watershed in good condition protects Tucson from floods that might surpass the city's flood control channel design. If the basin were fully developed, flood peaks could increase by an estimated 25-50% (Knight 1996).

Water Wells

The Arizona Department of Water Resources has 131 ground water wells registered for the Cienega Creek watershed in its Ground Water Site Inventory (GWSI) database. Sixty-one of the wells are in Pima County, 60 in Santa Cruz County, and 10 in Cochise County. The watershed on the Empire-Cienega, Empirita, and Rose Tree ranches has about 90 wells.

The planning area's water wells have been developed over many years for different uses. The main uses include domestic water for people living on ranches and water for livestock and wildlife, recreational uses, and fire fighting. Some of the existing wells were developed by the Gulf America Corporation (for expected future subdivision) and Anamax Copper (for use in future mining in the Santa Rita Mountains). Jack Greenway **developed wells for livestock and domestic water use**. ~~and~~ Sam Bell developed a few irrigation wells on the Cienega Ranch for farming (See list of water wells in Appendix 3).

Surface Water

Springs and Reservoirs (Surface Water Impoundments)

Significant springs in the planning area include Cold Spring, Upper Empire Gulch Spring, Apache Spring, Post Canyon, Smitty Spring, Nogales Spring, and Little Nogales Spring. Perennial ponds include Clyne's Pond (Northwest Reservoir); Cienega Ranch Marsh; and five ponds in Cinco Canyon: # 1, #2, # 3, # 4, and # 7. Early settlers developed most springs when they filed their homestead claims. Some springs have been developed for livestock use. Most developed springs have not been maintained and are used seasonally by wildlife and livestock (See list of springs and reservoirs in Appendix 3).

Streams

Cienega Creek has perennial flow for 8.3 miles and its tributaries Mattie Canyon and Empire Gulch have perennial flow for 1.1 and 0.9 miles, respectively (See Map 3-1). Although Cienega Creek and its tributaries have about 10.3 miles of surface water, during droughts the water flow becomes interrupted in places resulting in dewatered stream segments or a series of unconnected pools. Cienega Creek had a loss of

surface water from the canal diversion to Spring Water Canyon (0.75 miles) in the summer of 1997 and a loss of water from Apache Canyon to the Narrows (0.5 miles) in the summer of 1994. Normally, perennial stream segments that go dry during drought total about 1.25 miles or 10% of the stream length.

The University of Arizona measured instantaneous discharge on Cienega Creek from 1975 to 1983 and BLM made these measurements from 1988 to 1994. For 8 years of record the mean stream flow was 2.84 cubic feet/second (cfs) (2,050 acre-feet/year) as measured monthly at a station in the reach between Pump and Fresno canyons. Upstream from its confluence with Mattie Canyon, Cienega Creek's flow diminishes, mainly due to depth of bedrock. At the flow measurement station near the confluence of Oak Tree Canyon and Cienega Creek, base flows ranged from 0.3 to 0.9 cfs between 1988 and 1982. In 1994, BLM discontinued its instantaneous flow measurements at the two locations.

In 1995, a stream gaging station (water level recorder and galvanized housing) was installed at the site of an old masonry dam on Cienega Creek just above the confluence with Sanford Canyon. Continuous operation of this gage has been limited by maintenance problems and inundation by flood flows. The BLM is currently working with the U.S. Geological Survey (USGS) to rebuild this gage and put it in their "real time" gage network for Arizona.

Water Quality

The Arizona Department of Environmental Quality (ADEQ) is responsible for water quality in Arizona. ADEQ conducts biennial statewide surface water quality assessments and produces a report that lists streams that are not meeting state water quality standards for their designated uses. In the most recent report, ADEQ designated Cienega Creek and its tributaries in the Upper CienegaCreek basin for the following uses: aquatic and wildlife (warm water fisheries), full body contact (swimming), and livestock use. ADEQ took relatively few samples but did sample three stations on Cienega Creek between 1991 and 1995. Those samples met state standards showing that surface water in the Upper CienegaCreek basin was fully supporting its designated uses.

Fecal coliform, fecal strep, ammonia, and sulfides have been detected in the upper basin and occasionally exceeded state water quality standards over the monitoring period of 1992 and 1993. The source of the fecal contamination was found to be animal (likely cows and other animals). All other water quality parameters have been within acceptable limits (BLM files). ~~ADEQ sampled three stations on Cienega Creek between 1991 and 1995.~~ All samples met water quality standards for the designated uses of warm water fisheries, full body contact, and livestock watering.

Groundwater is the source of all domestic water uses in the Sonoita area. It is pumped from the Upper Cienega Creek Basin and is of high quality. As of 1998, no water from any municipal or domestic wells was being treated. (ADEQ 1998).

Unique Waters

ADEQ has classified a segment of Cienega Creek below the planning area as a unique water--a water body determined to be one of Arizona's outstanding water resources for at least one of the following criteria: exceptional recreational or ecological significance, such as

important geology, flora, fauna, water quality, aesthetic values, or wilderness characteristics.

Cienega Creek's designation is based upon its importance as a natural groundwater recharge area, as a flood control area, and as habitat for the longfin dace, a native fish. These qualities, as well as values of endangered species habitat, also characterize the segment of Cienega Creek in the Empire-Cienega Planning Area. This segment was recently nominated as a unique water (ADEQ 1999). **Upper Cienega Creek below Gardner Canyon was designated as a Unique Water early in 2002.**

Water Rights

After acquiring public lands in the Empire-Cienega Planning Area in 1988, BLM submitted new water right claims to the Arizona Department of Water Resources (ADWR) for adjudication. The planning area contains 246 water sources with 254 filings within the San Pedro River watershed and 319 sources with 357 filings in the Santa Cruz River watershed.

FIRE

Wildfire

The wildland fire situation in the Empire-Cienega Planning Area is critical from March through July because of the continuous stand of cured grass that easily ignites. Wildfires can quickly consume thousands of acres. The fire danger lessens in late July and August with the return of seasonal rainfall and high humidity. About 50% of all wildfires in this area are human caused.

The planning area's wildland-urban interface brings complexity to the wildland fire situation. Many primary residences and out structures occupy public and private land. Twelve structures are on public land and hundreds of other residences and outbuildings are on intermixed and adjacent private lands. Any wildfire can quickly and seriously threaten these structures. The intensity of the wildland-urban interface fire situation is predicted to increase due to new construction in the area.

Fire History

Records from 1980 through 1988 show that 44 fires burned in the planning area (Arizona State Land Department) charring from 1 to 4,000 acres each. Thirty-six percent of all fires burned 100 acres or more before being controlled. Fifty percent of all wildland fires were human caused. Table 3-5 summarizes more recent fire history for the BLM Safford-Tucson Fire Zone encompassing areas administered by the BLM Safford and Tucson field offices. Using the 5-year average from 1993-1997, one can calculate that Arizona BLM responded to an average of 251 fires per year. These fires burned 31,197 acres in the Safford-Tucson Zone.

The cause of the wildland fires varies from year to year. From 1993 to 1997, 42% of the fires (25% of the acres burned) were human caused. This percentage contrasts to that of the previous five years (1988-1992), during which 50% of the fires (41% of the acres burned) were human caused.

Wildland fires in the planning area most often burn on uplands in short grass with scattered mesquite and shrubs. These fires are usually of low intensity but move rapidly through the cured grass and associated vegetation. Grass heights vary from 1 to 3 feet on upland sites (short grass) with densities increasing from north to south. In short grass, flame lengths of up to six feet can spread at a rate of up to 5,148 feet per hour.

Table 3-5
Fire History - BLM Safford/Tucson Zone

	Human Caused		Lightning Caused		Percentage of Fires		Percentage of Acres	
Year	Average # Fires	Acres Burned	Average # Fires	Acres Burned	Human Caused	Lightning Caused	Human Caused	Lightning Caused
83-87	73	3,453	67	8,429	51	49	31	69
88-92	87	3,160	91	3,747	50	50	41	59
93-97	104	7,228	147	23,969	42	58	25	75

Fuels in riparian areas and bottomlands are dominated by tall grasses of up to 5 or 6 feet tall growing with mesquite, cottonwood, and other riparian trees. Fires in these fuels burn hotter than in the predominately short grass areas and exhibit moderate resistance to control. Fire in sacaton grass can display flame lengths of up to 12 feet and can spread at a rate of up to 6,864 feet per hour.

Fuels in the uplands and canyons consist mainly of shrubs with a short grass understory along with scattered juniper trees and other desert shrubs. This fuel type is common in the northern and eastern portions of the planning area. Fires can move rapidly through this fuel depending on the density of the grass understory. Resistance to control is low to moderate. Fire flame lengths and rates of movement vary depending on fuel moisture and weather conditions.

Prescribed Fire

The planning area's prescribed fire history is limited. Records from years before BLM's acquisition of the Empire-Cienega property show that recent prescribed burning was limited to small research burns conducted by the U.S. Department of Agriculture, Agricultural Research Service. These research burns have continued periodically since BLM's acquisition of the area. Small prescribed fires have also been conducted on the Appleton-Whittell ACEC (Research Ranch) over the past two years.

In the early 1970s, Sam Bell burned 49 Wash almost to 49 windmill, burned from north of the Agricultural Fields to Dominguez on the east side of Cienega Creek, and burned both sides of Cienega Creek south of the Cienega Ranch (Gerald Korte, Letter to BLM received November 26, 2001).

BIOLOGICAL RESOURCES/PROCESSES

UPLAND VEGETATION

Vegetation can be classified in a variety of ways for different purposes. For this planning effort, we are using ecological site descriptions developed by the Natural Resource Conservation Service (NRCS). These descriptions provide a system for describing existing vegetation and for comparing existing vegetation conditions to potential or desired future conditions

Major Land Resource Areas

Arizona was divided into major land resource areas (MLRAs) in the 1960s (SCS 1981) (See Map 3-2). MLRAs are broad geographic areas

having similar topography, climate, soils, and vegetation. In the 1970s, the MLRAs were further divided into sub-resource areas to obtain high-quality ecological site descriptions. Ecological (range) sites have been described for each MLRA.

In southeastern Arizona, the semidesert grasslands of the Southern Arizona Semidesert Grassland Resource Unit (41-3AZ) are perennial grass-shrub dominated rangelands which are positioned between the lower elevation shrublands of the Chihuahuan-Sonoran Desert Shrub (41-2AZ) and Upper Sonoran Desert Shrub (40-1AZ) resource areas and the higher elevation plains grassland and oak-grass savannah of the Mexican Oak-Pine Woodland and Oak Savannah resource area (41-1AZ) (Map 3-2).

The Empire-Cienega Planning Area encompasses about 170,000 acres within the Southeast Arizona Basin and Range Major Land Resource Area (MLRA-41) in the upper end of the 12- to 16-inch precipitation zone. The vegetation in the planning area grows predominately within the Southern Arizona Semidesert Grassland Resource Unit (41-3AZ, 12-16 inch precipitation zone) while higher elevations of the planning area support vegetation in the Mexican Oak-Pine Woodland and Oak Savannah resource area (41-1AZ, 16-20 inch precipitation zone) (Map 3-2).

The planning area is within one of North America's most diverse ecological areas, where the Sonoran, Chihuahuan, and Madrean life zones all come together. The current potential natural vegetation includes oak savannah, open grasslands, and desert shrub. Douglas-fir, Emory oak, and Mexican pinyon dominate the higher elevation woodlands. Cane beardgrass, sideoats grama, blue grama, threeawn species, and plains lovegrass dominate the grassland understories and open grasslands. Whitethorn, cholla, prickly pear, fourwing saltbush, ocotillo, and mesquite, with understories of perennial grasses, grow at the lower to mid elevations.

In the hilly country on both the west and east sides of Cienega Creek, northern exposures support plant communities characteristic of the 16-20 inch precipitation zone. Southern exposures support plant communities characteristic of the 12-16 inch precipitation zone. Table 3-6 summarizes the planning area's MLRAs and corresponding Brown and Lowe biotic communities (Brown, D. 1982).

Ecological Sites

An ecological site is a unit of land occupying a specific environmental zone (MLRA) and capable of supporting a native plant community typified by an association of plant species that differs from other ecological sites in the kind or proportion of species. Within the MLRAs, the ecological sites are delineated by such criteria as topographic position, percent slope, soils and parent geologic material, precipitation, and elevation. Table 3-7 lists Sonoita Valley ecological sites within MLRA 41 - Southeastern Arizona Basin and Range.

Ecological site descriptions are based on the concept of ecological site potential. The historic climax plant community--what could grow in response to the physical characteristics--may differ greatly from the existing plant community, which has been influenced by environmental variation or management practices. The ecological site approach recognizes that different vegetation states can occur on similar sites because of different environmental forces or land management practices.

Map 3-2
Major Land Resource Areas (MLRAs) of Arizona

Table 3-6
Description of Major Land Resource Areas and Historic Climax Plant Communities in the Empire-Cienega Planning Area

Major Land Resource Area	Corresponding Brown-Lowe (Vegetation Communities)	Selected Characteristics of Major Land Resource Areas			
		Elevation (in feet)	Landform Geology	Potential Climate	Historic Climax Plant Community
41-1AZ Oak-Pine Woodland and Oak Savannah	Madrean-Evergreen Woodland	5,500 to 8,500	Steep, rocky hills and mountains	Ppt 16-35" 60% during summer	Mexican blue, Arizona white, Emory and silverleaf oaks; Arizona rosewood; mountain mahogany; Mexican pinyon, Apache and Chihuahuan pine; manzanita; turbinella oak; silktassel; skunkbush; sideoats, hairy, and spruce top gramas; deergrass; Texas little and cane bluestem; plains lovegrass.
	Plains Grassland		Gently to strongly sloping fans, and level valley floors		Sideoats, hairy, and spruce top gramas; Crinkle-awn, bullgrass, wolftail, Texas timothy, little and cane bluestem; plains lovegrass.
41-3AZ Southern Arizona Semidesert Grassland	Semidesert-Grassland	3,500 to 5,500	Gently to strongly sloping fans, and level valley floors	Ppt 12-16" 60% during June through Sept.	Sideoats, black, hairy, blue, slender and spruce top gramas; bush muhly; Arizona cottontop; cane bluestem; alkali and big sacaton; vine mesquite; plains lovegrass; squirreltail; tobosa; fourwing saltbush; soaptree yucca; range ratany; false mesquite; shrubby buckwheat.

A vegetation state is the general description of the ecological site's characteristics. As the characteristics change, a site changes to a new state. The different plant communities produced by an ecological site are called vegetation states. The processes that cause a shift from one state to another are called transitional pathways.

Historic and Existing Upland Vegetation States

Before European settlement the upland ecological sites in the Empire-Cienega Planning Area were in a balance with a prevailing pattern of large,fast-burning wildfires consuming huge amounts of the perennial grass in late spring and early summer before the summer monsoons. These wildfires controlled invasive brush and trees. They helped recycle nutrients. And they resulted in the rapid regrowth of fresh perennial grasses. The visual aspect of the rangeland was an open grassland dominated by perennial grasses such as plains lovegrass, cane beardgrass, sideoats grama, black grama, blue grama, bush muhly, sacaton, vine mesquite, and several threeawn species intermixed with leaf succulents, including yuccas, agaves, and beargrass. But mesquite, burroweed, whitethorn, snakeweed, and Lehmann's lovegrass have invaded much of the planning area to various degrees.

Table 3-7
Sonoita Valley Ecosites within Major Land Resource Area (MLRA) 41 - Southeastern Arizona Basin and Range

Ecological Site Descriptions	
41-3AZ-Southern Arizona Semidesert Grassland	41-1AZ-Mexican Oak-Pine Woodland and Oak Savannah
Basalt Hills, 12-16"precip. zone	Limestone Hills, 16-20"precip. zone
Clayey Hills, 12-16"precip. zone	Limy Slopes, 16-20"precip. zone
Limestone Hills, 12-16"precip. zone	Limy Upland, 16-20"precip. zone
Limy Slopes, 12-16"precip. zone	Loamy Bottom, 16-20precip. zone
Limy Upland, 12-16"precip. zone	Loamy Bottom, subirrigated, 16-20"precip. zone
Loamy Bottom, ~~(PRJU),~~ 12-16"precip. zone	Loamy Hills, 16-20"precip. zone
Loamy Bottom, Subirrigated, 12-16"precip. zone	Loamy Upland, 16-20"precip. zone
Loamy Bottom, Swales, 12-16"precip. zone	Sandy Bottom ~~(QUEM, QUAR),~~ 16-20"precip. zone
Loamy Hills, 12-16"precip. zone	Sandy Bottom, subirrigated, ~~(PLWR, JUMA, FRVE2),~~ 16-20"precip. zone
Loamy Upland, 12-16"precip. zone	Sandyloam Upland, 16-20"precip. zone
Sandy Bottom, 12-16"precip. zone	Volcanic Hills, 16-20"precip. zone
Sandy Bottom, Subirrigated, ~~(POFR, SAGO)~~, 12-16"precip. zone	Loamy Bottom, Swales, 16-20"precip. zone
Sandy Loam Upland, 12-16"precip. zone	Loamy Upland, Limy, 16-20"precip. zone
Sandy Loam Deep, 12-16"precip. zone	Shallow Upland, 16-20"precip. zone
Shallow Upland, 12-16"precip. zone	
Volcanic Hills, 12-16"precip. zone	

Continuous livestock grazing, climatic changes, and suppression of wildfire over the past century have reduced desirable perennial grasses and changed much of the area from the native mid-grass historic climax plant community to a native grass-mesquite-half shrub state or a mixed native/Lehmann's lovegrass-mesquite-half shrub vegetation state. The historic vegetation states are shown in Map 3-3. Existing vegetation states are shown in Map 3-4.

Ecological Processes in Grasslands

Upland vegetation communities change over time due to environmental influences. The vegetation communities continuously move among a series of ecological states in response to disturbance factors such as climate, grazing, fire, and disease.

The present vegetation communities in the planning area are an expression of climate, the past disturbance regimes and land use practices.

Above average winter precipitation tends to favor growth and seedling establishment of mesquite and other shrub species while above average summer precipitation tends to favor growth and seedling establishment of perennial grass species (Wilson, et al. 2001). This variability may partially explain the dynamic fluctuations of plant community structure and species composition, although long-term direction changes in plants communities (from grassland to mesquite woodland, for example) are more influenced by human activities: grazing, wood cutting, mining, settlement patterns, species introductions, etc. (Bahre 1991).

Map 3-3
Historic (Desired) - Vegetation Condition

Map 3-4
Existing Vegetation Condition

In the planning area's semidesert grasslands before European settlement, fire was probably the single most common disturbance controlling the transition from open grassland states to shrub- and tree-invaded states on the upland ecological sites. Periodic wildfires reduced shrub cover and allowed grasses to remain dominant.

Livestock grazing played a major role in defining the present ecological states of the grasslands. Year-long grazing gave cattle the greatest opportunity to selectively graze preferred plants. This grazing resulted in undue intensity and frequency of defoliation of these species placing them at a disadvantage in plant competition. Livestock can select for unpalatable species, such as various forbs and shrubs, by reducing competition through consumption of desirable species. The frequency of fire in these grasslands was later reduced by removal of these perennial grasses as fuels and by human fire suppression. Under heavy grazing and with low fire occurrence, shrubs will generally remain until removed by fire or some other disturbance. Mesquite, burroweed, whitethorn, and other shrubs have increased in response to the loss of perennial grasses in some areas.

Other land use practices also affected ecological conditions. In the 1970s, Sam Bell maintained a large woodcutting operation and harvested most of the mature (mesquite) trees in the 49 Wash area, along Cienega Creek from north of the Agricultural Fields to vicinity of Pump Canyon confluence, and along Cienega Creek from the Cienega Ranch south. Stumps were burned and uprooted by bulldozer. The removal of trees in some areas contributed to loss of sacaton and other perennial and annual grass cover and resulted in some areas in bare ground, erosion, and invasion of white-thorn and other shrubs (Gerald Korte, Letter to BLM received November 26, 2001).

Ecological Site Inventories

Ecological site inventories delineate and measure existing plant communities and compare these communities to potential plant communities that could grow on the same site as a result of changes in management actions.

Ecological site delineations are landscape divisions used to provide order to a complex system of vegetation in regions. The major significance of the concept includes its ecological relevance. Soils data play the major role in extending existing data to similar environmental conditions. Often, changes in soils will define a unique vegetation community and ecological site. But similar vegetation communities may grow on different soils, and therefore the ecological sites may be a unique soil series or an association of different soils with properties that produce similar vegetation. Ecological site delineations require more than a soils map. Vegetation analysis in the field is a must (Ruyle-Range Site Concept: URL: http://ag.arizona.edu/OALS/agnic/siteguides/concept.html).

For each ecological site, the Natural Resources Conservation Service (NRCS) develops and maintains ecological site descriptions, which include descriptions of the historic climax plant community (NRCS Grazing Lands Technology Institute 1997, *National Range and Pasture Handbook*). The historic climax plant community is based upon the ecological potential and capability of each site. The ecological site descriptions are used in the ecological site inventory to determine present vegetation condition by comparing the present vegetation to vegetation states that can exist on the site, including the historic climax plant community. The comparison can be made

through a similarity index. The index is expressed as the percentage of the desired plant community that is present on the site. In assessing a site's condition or degree of function, the evaluation compares each site to its own potential.

A comparison of the present plant community to the historic climax plant community on a particular ecological site provides: (1) a basis for describing the extent and direction of changes that have taken place, and (2) a way of predicting changes that can take place in the plant community as a result of a specific treatment or management action. The similarity index of a site to the historic climax community, therefore, measures change

This index shows how climate and management have affected a site's plant community. This information gives us a starting point for setting objectives and monitoring progress in achieving them. The goal is often to change the present plant community toward a plant community that better protects the health of the basic rangeland resource. Or, the resource objective may be to achieve a certain habitat type or mosaic for wildlife management or endangered species recovery (NRCS Grazing Lands Technology Institute 1997).

BLM has completed ecological site inventories on most of the planning area. The ecological site inventory for the Empire-Cienega allotment was completed in the fall of 1995, and the ecological site inventory for the Empirita allotment was completed in 1994 (Map 3-5). Ecological site inventories have not been completed for the Rose Tree and Vera Earl allotments or for lands within the Empire Mountains. ~~An ecological site inventory is in progress for the Appleton-Whittell ACEC (Research Ranch).~~ **The Appleton-Whittell (Research Ranch) property has had a new ecological site inventory and soil survey completed by NRCS and the Research Ranch in the spring of 2001**. Table 3-8 summarizes the ecological sites within the Empire-Cienega and Empirita portions of the planning area. More detailed descriptions of the ecological sites and more information on the ecological site inventories and monitoring locations are included in Appendix 3, Ecological Site Inventories. Plant communities on these ecological sites are strongly influenced by the soil's ability to capture water from intense summer thunderstorms. Sites with sand to sandy loam surface textures are more productive in this resource area because of their ability to capture most of the summer rain. These sites produce extremely diverse and productive grasslands. Ecological sites with heavier textured surfaces allow most of the summer moisture to run off. The slow, gentle winter rains provide most of the soil moisture on these sites, which tend to support more deep rooted shrubs.

RIPARIAN AND WETLAND AREAS

About 18.5 miles of riparian habitat occur along Cienega Creek and its tributaries--Mattie Canyon, Empire Gulch, Gardner Canyon, Mud Springs, and North Canyon--on BLM-administered public land (Map 3-6). An additional 2.2 miles are present on intermixed State Trust Lands. The cienega or marsh vegetation that gives Cienega Creek its name occurs within most of its perennial reaches. The stream banks are dominated by deer grass with varying densities of cottonwood/willow riparian woodland. Extensive sacaton grasslands occupy the stream terraces along Cienega Creek south of its confluence with Mattie Canyon. North of the Mattie Canyon confluence, mesquite bosques grow next to the cottonwood-willow dominated riparian woodlands. Several natural perennial ponds with cienega vegetation are also found in the sacaton grasslands on the Cienega Creek floodplain.

Map 3-5
Ecological Sites

Table 3-8
Ecological Sites Within the Empire-Cienega and Empirita Ranch Areas

Ecological Site	Similarity Index to Historic Climax (Range)	Visual Aspect-Historic Climax Plant Community	Acres	% of Total
Basalt Hills	71	Shrub-Grass Mixed	601	0.6
Deep Sandy Loam/Sandy Bottom		Grassland	1,494	1.5
Limestone Hills and Limestone Hills/ Limey Upland/Volcanic Hills	60-67	Shrubland Mixed with Grassland	5,847	5.8
Limy Slopes and Limy Slopes/Limy Upland and Limy Slopes/Loamy Upland	54-60	Shrubland Mixed with Grassland	37,533	37.3
Loamy Bottom/Subirrigated	66	Sacaton	3,744	3.7
Loamy Bottom/Mesquite	N/A	Mesquite Bosque	581	0.6
Loamy Hills and Loamy Hills/Limy Slopes	59-92	Oak Woodland with Grassland	16,108	16.0
Loamy Upland		Grassland (Savannah)	115	0.1
Loamy Upland/Swales	42-77	Grassland	6,577	6.5
Sandy Bottom/Swales	65	Xeroriparian with Grassland	1,528	1.5
Sandy Bottom/Subirrigated	N/A	Deciduous Riparian Woodland	614	0.6
Sandy Loam Upland/Loamy Upland	31-54	Grassland (Savannah)	11,523	11.5
Volcanic Hills and Volcanic Hills/Limy Slopes and Volcanic Hills/Shallow Upland/Clay Hills	66-85	Oak Woodland Intermixed with Grasses and Shrubs	14,350	14.3
TOTAL:			**100,616**	**100**

Sonoran Riparian Deciduous Woodland

The planning area's riparian woodlands occur on the Sandy Bottom-Subirrigated ecological site on the low stream terrace and stream banks of the wet reaches of Cienega Creek, Empire Gulch, and Lower Mattie Canyon. This site benefits from high water tables and the extra moisture from flooding. Soils are deep and sandy. Slopes are nearly level. The potential plant community is a southwestern deciduous riparian woodland dominated by Fremont cottonwood (*Populus Fremontii)* and Goodding willow (*Salix gooddingii*). Tree canopy can be as high as 70% on this site. Other trees found in minor amounts include velvet ash (*Fraxinus pensylvanica),* Arizona walnut (*Juglans major)* and netleaf hackberry (*Celtis reticulata*). Seep willow (*Baccharis glutinosa)* is a common shrub in the understory.

Southern Arizona Warm-Temperate Riverine Marshes (Cienegas)

This is the cienega or marsh community for which Cienega Creek is named for but which

Map 3-6
Riparian Areas

an ecological site description has not been developed. Cienegas occur within wide, gently sloping valleys where flood velocities are readily dissipated and at sites where ground water intersects the surface to form areas of deep to shallow perennial water bordered by drier margins with intermittently saturated soils.

Cienega vegetation often grows in zones or bands that reflect these gradients of water availability. Areas with saturated soil or shallow water are vegetated mainly by grasses (Gramineae) and by low-statured emergents including rushes (*Juncus* spp), sedges (*Carex* spp), flat sedges (*Cyperus* spp) and spike rushes (*Eleocharis* spp). Deeper pools support submergent aquatic vegetation such as penny wort (*Hydrocotyle* spp) and stonewort (*Chara* spp).

Cienega soils consist of layers of organic peats and fine-textured silts. These soils can build to depths of several meters, as the productive cienega vegetation annually grows and decomposes and as silts are trapped during flood flows. The sponge-like organic soils store water and increase base flows during droughts. And the cienega's densely vegetated surface moderates peak flows during wet periods (BLM files; Fernald 1987; Hendrickson and Minckley 1984).

Along Cienega Creek, representative aquatic and semiaquatic vegetation includes: deer grass (*Muhlenbergia rigens)*, cattail (*Typha latifolia*, *Typha domingensis*), bulrushes (*Scirpus*), rushes (*Eleocharis, Juncus*, ~~*Carex*~~), sedges (*Cyperus, Carex*), yerba mansa (*Anemopsis californica*), Goodding willow, water parsnip (*Berula erecta*), stonewort (*Chara*), horned pond-weed (*Zannachellia palustris*), penny-wort (*hydrocotyle verticillata)*, and speedwell (*Veronica)*. Cienega Creek is bordered by the Riparian Woodland community as described above.

Aquatic and Riparian Processes

Riparian areas and associated stream channels constantly undergo change. The riparian area and associated aquatic habitat are exposed to natural external factors, mainly stream flow and sediment transport (Rosgen 1996; Swanston 1991).

Properly functioning riparian areas change gradually and have adequate vegetation, floodplain development, or woody debris to dissipate flood energies (BLM 1993). Water from floods is slowed and spread out on floodplains where it can seep into the soil and drop sediment, which builds banks and floodplains.

Canyon-Bound Streams

Riparian vegetation, mainly in the form of cottonwoods, willows, and deer grass, holds soil against erosion and improves fish habitat by holding banks and allowing a diversity of fish habitat types to form through sediment scour and deposition. In this way riparian plants influence the formation of pools, cover, riffles, runs, bars, braids, and clean spawning habitat. But large floods may scour riparian vegetation and stream banks, where the floodplain has been reduced by narrow canyon features of channelization or where bank vegetation has been reduced.

Rainfall and watershed conditions influence flooding. Watersheds dominated by bare ground or with reduced ground cover foster flash flooding. Flash flooding in turn can destabilize channel features as the stream adjusts to the new flood and sediment regime (Rosgen 1996). Excess sediment from these unstable watersheds can fill with fine sediment important fish habitat features such as pools and riffles. And

tributaries adjusting to a new base level in a down-cut mainstem stream can inflict other damage.

Riparian vegetation goes through stages of development as young trees grow older and sediment deposition builds banks and terraces that alter the soil-water relationships that influence plant species composition, density, and abundance. Early stages (early seral) have fewer species and younger age classes of trees. Later stages (late seral) have more species and more older trees. If a riparian area can function unimpaired by disruptive land practices, it may attain its potential (BLM Proper Functioning Condition Work Group 1993, Figure 3).

Flooding serves to disturb the riparian community and allow new seed beds to develop for tree seedlings and openings for herbaceous plants. The result is a mosaic of plant species, age classes, and microclimates--a mosaic that supports a diversity of habitat conditions and animals.

The impairment of vegetation development that reduces vegetation density, plant vigor, or production directly alters the integrity of floodplains and stream banks. This impairment leaves the degraded riparian area vulnerable to further damage by flooding as the riparian community has lost its ability to dissipate flood energy and resist erosion (BLM Proper Functioning Condition Work Group 1993; BLM Channel Evolution 1990, Figure 2).

Cienegas

Unlike most riparian areas dominated by trees, herbaceous marsh vegetation holds soil against erosion. This action improves fish habitat by holding soil and banks that allow for a diversity of fish habitat types to form through sediment scour and deposition (Rosgen1996; Hendrickson and Minckley 1984; Leopold 1997; Medina et al. 1995). In this way wetland plants influence the formation of pools, runs, and riffles. Wetland plants also contribute to habitat quality by providing undercut banks, overhanging cover, shade, and escape cover in spaces between plant stems.

Beaver are thought to have played an important role in forming and perpetuating cienegas. Their dams prevent erosion, collect and retain organic matter and sediment, and raise water tables. Beaver are known to have been present along “Cienegas de Los Pimas,” which stretched from the town of Tucson to Pantano before statehood (Hendrickson and Minckley 1984).

Channel scouring and sediment deposition on the floodplain continually change soil conditions and stream channel features. These changes influence plant community dynamics and channel features (pools, runs, riffles).

The composition and structure of the riparian community can likewise influence sediment deposition and soil stability creating a dynamic feedback response between the plant community and physical processes (Hendrickson and Minckley 1984; Medina et al. 1995). For example, rushes, bunch grasses, carpets of sedges, and stands of willows trap sediment during floods. These plants also bind soils with roots (Cornwall 1998). Herbaceous plants with deep fibrous roots and the highest stem density and above-ground biomass in cienega wetlands provide the most soil stability and are not disturbed even by large floods (Cornwall 1998; Hendrickson and Minckley 1984). Instead, floods act on “nick points” where vegetation has been disturbed and turbulence exists during floods. As bed material is scoured, it is redepositied in run or riffle areas at the toe of the pool and adjacent floodplain.

Riffles and runs contain armored sediments that are further stabilized by vegetation, especially plant roots, which cover the floodplain and cross

runs and riffles (Medina et al. 1995). "Nick points" that turn into pools eventually stabilize when they reach bed materials or vegetation thick enough to prevent further erosion. As a result of these processes, Cienega Creek contains "slit pools" over 6 feet deep as well as runs and riffles that average less than 6 inches deep. These pools, runs, and riffles are often surrounded by saturated soil or thin sheets of standing water with thick mats of marshland vegetation and Goodding willows.

Flooding and sediment input are influenced by rainfall and watershed characteristics and condition/health (NRCS 1994; Brooks et al. 1991). Watersheds dominated by bare ground or with reduced ground cover foster larger flood peaks, which can destabilize cienegas (Leopold 1994; Brooks et al. 1991; Hendrickson and Minckley 1984). Excess sediment from these unstable watersheds can fill with sediment important fish habitat features such as pools and riffles (Rosgen 1996; Leopold 1994, 1997; Meehan 1991). Over geologic time, rare heavy floods may scour marsh vegetation and stream banks, which are recolonized by plants and eventually evolve back into cienegas.

Aquatic Habitat

Aquatic habitats are controlled mainly by sediment input and transport, which are functions of the volume and pattern of precipitation and runoff. Watershed and riparian health influence sediment transport and runoff characteristics, which affect flood magnitude. Along the stream channel, high-gradient, narrow channels receive coarser substrate, while finer sediments are deposited where floodplains are wider and gradients lower. Pools tend to be permanent only where protected from excess sediment from ephemeral tributaries. When sediment input is excessive, pools may become rare due to sediment filling. In constrained canyon-bound reaches of streams, non-native fish cannot resist flooding. Unlike native fishes that have adapted to flooding in constrained canyon reaches, these exotic fishes tend to be eliminated or severely reduced by floods (Minckley and Meffe 1987).

In contrast, Cienega Creek is a valley bottom stream with a wide floodplain that is ideal for establishing and spreading non-native fishes to the exclusion of Gila chub and Gila topminnow. In this type of system, non-native fishes, once established, constitute a biotic habitat element that is incompatible with and can eliminate native fishes (Minckley and Deacon 1991)

Riparian and Wetland Area Condition and Inventory

BLM inventoried riparian areas along Cienega Creek and its tributaries on public lands from December 1988 through July 1989 (Table 3-9). The riparian inventory techniques are outlined in the BLM Phoenix District's Riparian Area Condition Evaluation (RACE) Handbook (BLM 1987d). As a result of the 1988-89 inventory, 11.1 miles (60%) of riparian habitat received ratings of 5-11 for an overall unsatisfactory rating, and 7.5 miles (40%) of riparian habitat received total ratings of 12-16 for an overall satisfactory rating.

The woody species regeneration rating was the major contributor to overall unsatisfactory ratings in 1988-89. Nipping of the apical meristem on seedling trees often stunts growth or kills seedlings and can prevent the establishing of young trees as replacements in the riparian system. Thus, where cattle and deer had nipped the tops of more than 80% of the young trees, the segment received the lowest rating for woody species regeneration. This heavy browsing occurred on 11.3 miles of riparian area of which 8.4 miles (or 74%) received overall ratings of unsatisfactory. An additional 2.9 miles of riparian area received

Table 3-9
Riparian Area Condition Evaluation (RACE) Summaries for Empire-Cienega Riparian Areas

		1989-1990		1993		2000	
Stream	**Length**	% length satisfactory	% length unsatisfactory	% length satisfactory	% length unsatisfactory	% length satisfactory	% length unsatisfactory
Cienega Creek	12.5	43[1]	57	71[2]	29	92[3]	8
Empire Gulch	3.3	40	60	-	-	-	-
Gardner Canyon	1.3	0	100	-	-	-	-
Mattie Canyon	1.2	100	0	-	-	-	-
North Canyon	0.6	0	100	-	-	-	-
Cienega Canal	0.9	0	100	-	-	-	-
Mud Springs	0.3	100	0	-	-	-	-
TOTAL:	**20.1**	**40[1]**	**60**	**71**	**29**	**92**	**8**

[1] Calculations exclude 1.5 miles of riparian area on Cienega Creek which were not sampled in 1989/90.
[2] Calculations exclude 0.6 miles of riparian area on Cienega Creek which were not sampled in 1993.
[3] Calculations exclude 0.6 miles which are no longer managed as riparian in 2000 due to lack of site potential.

woody species regeneration ratings of 1 and overall unsatisfactory ratings due to poor conditions for establishing seedling trees, such as lack of surface water.

BLM found the following other problems in riparian areas in 1988-89:

- Off-road vehicle travel in the creek bed.
- Bank alteration by vehicles, livestock, and old irrigation projects.
- Loss of vegetation cover from livestock use.
- Head cuts, which may have been caused by runoff from roads or past overgrazing.

Most of these problems have been corrected since 1990. Livestock access to riparian areas has been controlled by installing riparian fencing along most of Cienega Creek. BLM has closed several road crossings and rerouted traffic across hard-surfaced crossings. As a result, riparian conditions have improved markedly. Although the soils along Cienega Creek are highly erodible, increases in deer grass, willow, cottonwood, rushes, horsetail, and other plants have stabilized the banks to the point that even large floods do not affect most bank surfaces. Increases in riparian vegetation density have increased overstory and mid-story cover and vegetation cover on banks.

In 1993 and again in 2000, BLM re-assessed the riparian areas along Cienega Creek using the riparian evaluation portion of the RACE inventory. The results showed continued improvement along much of the creek. Of the 11.9 miles of riparian habitat evaluated in 1993,

8.5 miles (71%) were in satisfactory condition and 3.4 miles (29%) were in unsatisfactory condition. Of the 12.5 miles assessed in 2000, ~~100%~~ **92%** were in satisfactory condition(See Table 3-9 and Appendix 3, Riparian Area Conditions and Management). Riparian proper functioning condition assessments completed in 1993 and in 2000 showed similar trends with the percentage of the creek in proper functioning condition increasing from 2% to 61% (See Table 3-10 and Appendix 3, Riparian Area Conditions and Management).

Aquatic Habitat Condition and Inventory

In 1989-90 BLM classified all aquatic habitats along the perennial length of Cienega Creek and inventoried them for characteristics related to fish habitat. BLM inventoried habitat type and 12 parameters of habitat complexity, including depth, vegetation cover in the water, cover overhanging the water's surface, and undercut banks. In 2000, BLM re-assessed aquatic habitats along four segments of Cienega Creek to determine change over the 10-year period (Tables 3-11, 3-12, and 3-13). The selected segments varied from 0.28 to 0.52 miles in length. They were monitored for the same fish habitat characteristics as in 1989-90.

In 1989-90, livestock still grazed much of the area along Cienega Creek but grazing did not uniformly affect the creek. Cattle predominately used downstream segments lightly in the winter and impacts were limited. Impacts were heavier in warm-season pastures along the southern half of the creek. Many segments lacked overstory vegetation, overhanging vegetation, or undercut banks. Floating vegetation (filamentous algae mats) was a common cover type due to increased nutrient levels and fewer shaded habitats. In many segments, shallower and wider habitats such as glides and riffles predominated over deeper pool habitats.

In limited reaches of Cienega Creek, pool habitats were well developed. These habitats were generally surrounded by marsh and had a high degree of cover. Such cover included: emergent vegetation, submerged vegetation, exposed roots from deer grass and trees, undercut banks, and medium and small woody debris. Proportions of habitat types changed drastically for all four segments between 1990 and 2000. Rather than lumping all four segments together for comparison, this discussion covers each segment separately because each has different characteristics that influence aquatic habitat development.

The Headwaters segment showed a decrease in the area of pools, yet the number and depth of pools increased (Tables 3-11 and 3-12). Run, riffle, and glide all decreased while marsh increased. This segment is the only one that is changing from a pool habitat to a marsh habitat. The number of pools has increased as has their depth, showing that not all pool habitats are in jeopardy of total replacement by marsh.

But the data show that shallow habitats (run, riffle, glide) are on the verge of total replacement by the encroachment of dense herbaceous aquatic vegetation. This segment showed a 10-fold increase in vegetation cover and 10-fold increase in overhanging cover (Table 3-13). Undercut banks dramatically increased in that none were detected in 1990. The processes in the Headwaters segment are driven mainly by the small watershed size (78 mi^2) and lack of tributaries reaching higher elevations in nearby mountains where more rain falls. The sheltered existence of this segment from flood flows has produced an ecological site with fine sediments on shallow saturated banks and wide floodplains. The lack of disturbance of vegetation and bank soils from grazing has

Table 3-10
Riparian Proper Functioning Condition Assessment (PFC) Summaries for Empire-Cienega Riparian Areas

	1993[1]					2000[2]			
Stream	Length (miles)	% PFC	% Functional at Risk	% Non-Functional	% Unknown	Length[3] (miles)	% PFC	% Functional at Risk	% Non-Functional
Cienega Creek	12.5	4	78	18	0	11.9	67	33	0
Empire Gulch	3.3	0	100	0	0	3.3	39	61	0
Gardner Canyon	1.3	0	0	100	0	1.3			
Mattie Canyon	1.2	0	100	0	0	1.2			
North Canyon	0.6	0	0	100	0	0	0	0	0
Cienega Canal	0.9	0	100	0	0	0.9	0	100	0
Mud Springs	0.3	0	0	0	0.3	0.3			
TOTAL:	**20.1**	**2**	**75**	**21**	**2**	**18.9**	**61**	**39**	**0**

[1] Based on 1993 riparian inventory data for Cienega Creek and 1989/90 riparian inventory data for other streams.
[2] From riparian proper functioning condition assessments completed in 2000.
[3] A total of 0.6 miles of Cienega Creek and 0.6 miles of North Canyon are no longer managed as riparian areas in 2000 due to lack of site potential.

Table 3-11
Change in Aquatic Habitat Surface Area by Segment for Cienega Creek, 1990 and 2000

	Pool (%)		Run (%)		Riffle (%)		Glide (%)		Marsh (%)	
Segment	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Headwaters (above Gardner Canyon (59M)	64.1	35.5	4.2	0.5	15.0	0.0	4.6	0.2	12.1	63.8
Below Mattie Canyon (59F)	5.0	66.0	5.9	10.8	39.6	3.1	37.0	17.3	12.5	2.8
Below Pump Canyon (59D)	29.7	51.6	0.0	16.8	28.2	1.3	42.1	29.4	0.0	0.8
Fresno to Apache Canyon (59B)	13.3	50.4	0.0	5.3	51.7	4.3	34.3	38.5	0.7	1.5

Table 3-12
Pool Habitat Development by Segment for Cienega Creek, 1990 and 2000

	Pools Per Mile (All)		Pools (>2' Deep) Per Mile		Percent of All Aquatic Habitat	
Segment	1990	2000	1990	2000	1990	2000
Headwaters (Above Gardner Canyon) (59M)	61	79	32	43	64	36
Below Mattie Canyon (59F)	12	43	3	40	5	66
Below Pump Canyon (59D)	29	124	4	57	30	52
Fresno to Apache Canyon (59B)	12	112	0	0	13	50

Table 3-13
Some Key Aquatic Habitat Characteristics for Cienega Creek, 1990 and 2000

	Instream Cover Square Feet/Mile		Overhanging Cover Square Feet/Mile		Undercut Banks Running Feet/Mile	
Segment	1990	2000	1990	2000	1990	2000
Headwaters (Above Gardner Canyon) (59M)	1,343	13,472	424	4,231	0.0	789
Below Mattie Canyon (59F)	27,388	3,819	741	3,941	0.0	538
Below Pump Canyon (59D)	3,344	5,176	469	7,362	0.0	750
Fresno to Apache Canyon (59B)	2,591	297	51,801	4,794	0.0	18

allowed dense accumulations of aquatic plants (e.g., deer grass, Spanish needles, Baltic rush, spike rushes), which filter out sediments and raise bank elevations.

These actions, in turn, leave water with an increased capacity for moving sediment where sediments such as substrates are exposed on the bottoms of pool and glide habitats.

As plant density increases, so does the resistance to water movement. This resistance decreases the water's energy to transport sediment. The clean water leaving these areas has a low sediment load when it reaches areas with less resistance to flow such as pools and glides. In this way the differential in channel roughness created by plants is causing deposition of sediment where plants can root in shallow areas. This differential is also increasing bed scour where plants cannot establish in great densities, such as, in pools and glides. Glides may actually be converted to pools as they are excavated by floods changing the nature of the habitat.

The Headwaters segment has a low slope (about 0.5%) and lacks large flood flows and large sediment particles, such as cobble and rubble, to remove vegetation. Fencing the segment has also sheltered herbaceous vegetation and trees from disturbances by livestock.

The Mattie Canyon segment showed an increase in the area of pools as well as the number and depth of pools (Table 3-11 and 3-12). Over the

10-year period, riffle and marsh habitat both decreased while run and glide habitats increased. In contrast to the Headwaters segment, the Mattie Canyon segment showed a 86% decrease in vegetation cover in open habitats but a five-fold increase in overhanging cover during the same 10-year period (Table 3-13). Undercut banks increased dramatically because none were detected in 1990.

In contrast to the Headwaters segment, the processes in the Mattie Canyon segment differ mainly because of a larger watershed size (202 mi^2) and inputs from upstream tributaries that reach into higher elevations where more rain falls. Flood flows and sediment have produced ecological sites with a mixture of fine and coarse sediments on shallow banks and wide floodplains. Though the disturbance regime is much greater than for the Headwaters segment, dense accumulations of aquatic plants (e.g., deer grass, Spanish needles, Baltic rush, spike rushes) have developed on floodplains and to a lesser degree in the channels.

This denser vegetation on the floodplain filters sediments, raising bank elevations and increasing the water's capacity to move sediment. "Hungry" water can then scour exposed sediment, such as, the substrates of pool and glide habitats. In addition, increased woody debris along Cienega Creek allows flood waters to create areas of turbulence around logs and tree roots forming backwater pools. This habitat type was rarely found in 1990. In this way existing channel features, such as pools and glides, may be deepened while other locations remain shallow bound by root masses across the bottom of the channel or coarse sediment deposits on habitats such as runs and riffles. Although the Mattie Canyon segment has a low slope (about 0.5%), like the Headwaters segment, disturbance is increased by larger flood flows from a larger watershed and larger sediment particles, such as gravel and cobble, which can remove less durable components of herbaceous vegetation. This greater capacity for disturbance coupled with a large degree of tree canopy (i.e., overstory), which shades the stream, has resulted in less herbaceous instream cover and increased cover overhanging the water's surface.

The Pump Canyon segment showed an increase in the area of pools and the number and depth of pools (Tables 3-11 and 3-12). Riffle and glide habitat both decreased while marsh habitat slightly increased. This segment also showed a 1.5-fold increase in vegetation cover in pools and a 16-fold increase in overhanging cover (Table 3-13). Undercut banks increased in that none were detected in 1990. The Pump Canyon segment functions much as the Mattie Canyon segment except that Pump Canyon has a slightly larger watershed (211 mi^2) and an immature tree gallery that does not create the level of shade that limits herbaceous plant growth.

The Fresno Canyon segment showed an increase in area and number of pools (Tables 3-11 and 3-12). But depths remain relatively shallow. Run habitats increased while glide habitats remained relatively static. Marsh habitat doubled, yet still amounted to only 1.5% of all aquatic habitats. This segment showed a 89% decrease in aquatic vegetation cover over 10 years and a 91% decrease in overhanging cover. Undercut banks increased in that none were detected in 1990.

The Fresno Canyon segment functions much as do the Mattie Canyon and Pump Canyon segments except that Fresno Canyon has a slightly larger watershed (223 mi^2) and a large load of coarse sediments. These coarse sediments create a filling and scouring dynamic that limits the developing of habitat and establishing of herbaceous aquatic plants. This segment also has a larger degree of disturbance than the other segments. This disturbance, coupled with a large degree of mature tree canopy (i.e., overstory) that shades the stream, has resulted in less herbaceous instream cover

and decreased cover overhanging the water's surface.

FISH AND WILDLIFE

The quality and diversity of vegetation communities contribute to the planning area's value as wildlife habitat. Wildlife habitat attributes, including vegetation structure, plant species composition, and the presence or absence of physical features, determine wildlife presence and abundance in any given area. The high diversity of fish and wildlife species within the planning area results from the habitat diversity, including the presence of several rare plant communities (Table 3-14).

Table 3-14
Species Richness, Empire-Cienega Planning Area

Taxonomic Group	Number of Species
Mammals	60
Birds	230
Reptiles and Amphibians	43
Fish	3
TOTAL:	**336**

The riparian areas along Cienega Creek and its tributaries provide breeding, foraging, watering, resting, and escape cover as well as travel corridors for a variety of wildlife. Riparian habitats are important to wildlife in desert environments. Although never abundant, these habitats in Arizona have also been dramatically reduced by a variety of human impacts. Many of the federally listed and other special status species, entirely or partially, depend on riparian habitats. The relatively large, high-quality riparian habitats within the planning area have contributed to the presence of many special status species.

Three native fishes inhabit Cienega Creek and Mattie Canyon: the endangered Gila topminnow; the Gila chub--a federal candidate species--and the longfin dace. Lowland and Chiricahua leopard frogs, Sonoran mud turtles, and Mexican garter snakes inhabit several locations in Empire Gulch and Cienega Creek (Rosen 1996; BLM files). Lowland leopard frogs and Sonoran mud turtles can be found in Nogales and Little Nogales Springs and Wakefield Canyon. Incidental observations and literature reviews document the presence of six more species of amphibians and 33 species of reptiles within the planning area (See Appendix 3, Annotated Checklist of Fish, Amphibians, and Reptiles).

More than 230 bird species have been documented in the planning area including both resident and migratory species and such special status species as the gray hawk, osprey, Southwestern willow flycatcher, yellow-billed cuckoo, green kingfisher, and Baird's sparrow (See Appendix 3, Checklist of Birds). At least five species of raptors have been documented to nest in the riparian areas as well as great blue herons and many songbirds. Waterfowl use ponds and pools along the creek, and nesting Virginia rails have been found in the cienega habitat along its banks. The extensive open grasslands of predominately native grasses provide both breeding and wintering habitat for the rare grasshopper sparrow and wintering habitat for the Baird's sparrow. Both of these species are Arizona wildlife of special concern. These grasslands also provide foraging habitat for resident and migratory raptors, such as, the Swainson's and ferruginous hawks.

Also known to inhabit the area are 25 big-game, small-game, and predatory mammals; 27 small-

mammal species, and eight bat species (See Appendix 3, Mammal Species).

The foothills of the Whetstone and Empire mountains, as noted by James Bartlett in 1852, once provided excellent habitat for pronghorn, mule deer, and white-tailed deer (Davis 1982). These species have been in decline due to human encroachment, drought, and reduction in natural water sources. Pronghorn were extirpated from southeast Arizona by the 1920s and were reintroduced in the planning area by the Arizona Game and Fish Department in 1981 (AGFD 1981). Recent surveys place the population at about 100, but survival of pronghorn fawns has been low in recent years (Sacco 1999). Mule deer populations have undergone regional declines, and both white-tail and mule deer have undergone changes in local distribution.

A variety of other mammals also inhabit the planning area. Cottontail are common in shrubby habitats and black-tailed jackrabbits occur in open habitats. Raccoon and porcupine are found most often in riparian areas. Coatimundi inhabit dry canyons and riparian areas. Ringtail are found on rocky hillsides, usually near crevices, caves, mine shafts, and abandoned buildings. Predatory mammals include the mountain lion, bobcat, coyote, and grey fox.

The endangered lesser long-nosed bat and the Mexican long-tongued bat (BLM sensitive) forage on agaves, which are present in varying densities on loamy hills ecological sites. Other bats are attracted to the abundance of insects along riparian areas.

THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

Thirty-seven special status fish, wildlife, and plant species occur or have the potential to occur within the planning area. Included are the following:

- 11 federal candidate, threatened, or endangered fish, wildlife, and plant species (Table 3-15).
- 15 species proposed to be listed as wildlife of special concern in Arizona (AGFD in preparation) (Table 3-16).
- 11 species classified as BLM sensitive (Table 3-17).

These special status species mainly inhabit the planning area's rare riparian and grassland habitats.

Threatened and Endangered Fish and Wildlife Habitat Conditions and Inventory

Lesser Long-Nosed Bat

The lesser long-nosed bat, a federally listed endangered species, is a medium-sized nectar, pollen, and fruit eating bat that migrates seasonally from Mexico to southern Arizona and southwest New Mexico. This bat has a small triangular noseleaf, relatively small ears, and no tail. It ranges in southern Arizona from the Picacho Mountains southwest to the Agua Dulce Mountains, southeast to the Chiricahua Mountains, and south from Arizona throughout the drier parts of Mexico. The lesser long-nosed bat feeds on the fruits of columnar cacti and paniculate agave (USFWS 1988).

The lesser long-nosed bat roosts in caves and abandoned mines. The number of individuals per roost varies from a few to thousands. These

bats begin dispersing from maternity roosts in mid-July. From July through September on a transient basis they occupy a diverse series of roosts from high to low elevations. By late September these bats vacate Arizona and move into Mexico (USFWS 1988).

The planning area's loamy hills ecological sites support moderate to high densities of paniculate agaves, which are the main food source for migrating lesser long-nosed bats in late summer and early fall.

Simms and Dalton (1998) conducted a light-tagging study of lesser long-nosed bats in the planning area in September 1998. The objective of the study was to locate migratory day roosts of these bats. Another objective was to learn more about foraging territory and distances. During two nights of netting, the researchers captured and equipped 29 lesser long-nosed bats with chemiluminescent light tags. Observers tracked one of the bats to a known migratory roost in the Patagonia area, a distance of about 15 miles from the capture site. Other bats were documented foraging at hummingbird feeders in the planning area up to 15 miles from their capture location. The study found one new migratory roost. Several lesser long-nosed bat migratory roosts occur within 50 miles of the planning area.

Jaguar

The jaguar is the largest species of cat native to the Western Hemisphere and was recently listed as endangered in the United States. Jaguars are cinnamon-buff in color with many black spots. Melanistic forms are also known, mainly in the southern part of their range. Jaguar range in North America includes Mexico and portions of the Southwestern United States. A number of jaguar records are known from Arizona, New Mexico, and Texas (USFWS 1997a).

There are historic records of jaguar from the Santa Rita and Whetstone Mountains (Girmendonk 1994; Hoffmeister 1986) which border the planning area. Jaguar may use the planning area as a movement corridor, but confirmed sightings in the United States are extremely rare.

Aplomado Falcon

The aplomado falcon is a federally listed endangered species. It is a medium-sized falcon similar in size to the peregrine falcon. It has a moustache similar to the peregrine's but, unlike the peregrine, has a white line through its eye. When viewed from below, the aplomado falcon has a black belly contrasted by a pale throat and a orange-brown thigh. Aplomado falcons do not build their own nests but use abandoned nests of hawks and ravens. These falcons nest in small trees such as mesquite and catclaw. Their prey consists mainly of small birds but they may also eat winged insects, bats, rodents, and reptiles. Falcon distribution and reproduction may be influenced by available nest sites and abundance of small birds (USFWS 1990).

Aplomado falcons inhabit grasslands and savannas of Latin America. They formerly inhabited desert grasslands and coastal prairies of Texas, New Mexico, and southeast Arizona. In the United States, historic habitats consist of open grasslands with scattered yuccas and mesquites. The species will also occupy oak savannas, pine savannas, desert grasslands, and riparian woodlands (USFWS 1990). The aplomado falcon is one of six desert grassland priority species named in the Arizona Partners in Flight Bird Conservation Plan (Latta et al. 1999).

Corman (1992) surveyed the planning area for potential reintroduction sites for the northern aplomado falcon.

Table 3-15
Federally Listed or Candidate Species with Historic or Current Occurrences in the Cienega Creek Basin

Name	Federal Status	Habitat and Presence
Gila topminnow (*Poeciliopsis occidentalis occidentalis*)	FE	Pools, cienegas, backwaters, seeps, and springs. Present in Cienega Creek, Empire Gulch, and Mattie Canyon
Gila chub (*Gila intermedia*)	FC	Deep pools with overhanging banks/cover. Present in Cienega Creek and Mattie Canyon.
Desert pupfish (*Cyprinodon macularius*)	FE	Small, shallow pools, cienegas, backwaters, seeps, and springs. Historically present in the Santa Cruz and San Pedro river drainages. One reintroduced population is present in pond on private land within planning area. Proposed for reintroduction.
Chiricahua leopard frog (*Rana chiricahuensis*)	FP	Pools in stream channels and isolated pools at seeps and springs. Present recently in Cienega Creek, Empire Gulch, Mattie Canyon, and off-channel ponds. Declining numbers. Proposed for listing as threatened species.
Bald eagle (*Haliaeetus leucocephalus*)	FT	Large, open bodies of water for foraging; large trees or snags or cliffs for nesting. Transient in planning area.
Northern aplomado falcon (*Falco femoralis septentrionalis*)	FE	Open grassland habitats with scattered trees/yucca for nesting and perches. Extirpated.
Southwestern willow flycatcher (*Empidonax traillii extimus*)	FE	Dense willow and cottonwood habitats along streams with perennial water. Migratory individuals documented ~~but no breeding pairs confirmed in planning area.~~ for several years of record. One breeding pair successfully nested along Cienega Creek in 2001. Suitable habitat is present along Cienega Creek.
Lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*)	FE	Forages on agave in upland grassland habitats. Confirmed presence in planning area.
Jaguar (*Felis onca*)	FE	May use dense vegetation in river bottoms for foraging and travel corridors. Historical records from mountains next to planning area but no current records.
Canelo lady tresses orchid (*Spiranthes delitescens*)	FE	Present in drainages near planning area but not documented along Cienega Creek or tributaries.
Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*)	FE	Early successional species requiring periodic flooding and opening of streamside habitat and sand deposition. Has been found in Empire Gulch and along Cienega Creek.

FE = Federally listed as endangered.
FC = Candidate for federal listing. All species are also on the wildlife of special concern in Arizona (WSCA) list, (draft) Arizona Game and Fish Department.
FP= Proposed for federal listing.
FT = Federally listed as threatened.

Table 3-16
Proposed Wildlife of Special Concern in Arizona Occurring or Likely to Occur in the Empire-Cienega Planning Area

Name	Habitat	Presence
Mexican garter snake (*Thamnophis eques*)	Perennial stream segments and marshes along Cienega Creek and tributaries.	PC
Bunch grass lizard (*Sceloporus scalaris*)	Desert grassland.	PL
Lowland leopard frog (*Rana yavapaiensis*)	Perennial streams, springs, and pools within Cienega Creek watershed.	PC
Azure bluebird (*Sialia sialis fulva*)	Oak woodland, mainly in winter.	PL
Yellow-billed cuckoo (*Coccyzus americanus*)	Cottonwood-willow riparian areas along Cienega Creek and tributaries.	PC
Ferruginous hawk (*Buteo regalis*)	Occasional visitor, foraging in grassland habitats.	PC
Northern goshawk (*Accipter gentilis*)	Vagrant, usually dense coniferous forest.	PC
Swainson's hawk (*Buteo swainsoni*)	Regular breeder, grassland habitats.	PC
Green kingfisher (*Chloroceryle americana*)	Perennial streams, rare to regular visitor.	PC
Sprague's pipit (*Anthus spragueii*)	Desert grassland, open valley bottoms.	PC
Baird's sparrow (*Ammodramus bairdii*)	Desert grassland swales.	PC
Arizona grasshopper sparrow (*Ammodramus savannarum ammolegus*)	Desert grassland swales. Summer breeding population of particular concern.	PC
Western red bat (*Lasiurus blossevillii*)	Cottonwood willow riparian areas along Cienega Creek and tributaries.	PC
Townsend's big-eared bat (*Plecotus townsendii*)	Roosts in caves/mines, forages on insects in uplands or over water.	PC
Black-tailed prairie dog (*Cynomys ludovicianus*)	Open, desert grasslands.	EX

PC = Presence Confirmed. PL = Presence Likely. EX=Extirpated.

Table 3-17
BLM Sensitive Species Within Empire-Cienega Planning Area

Name	Habitat	Presence
Longfin dace	Pools and riffles in perennial streams.	PC
Texas horned lizard	Desert grassland.	PC
Gray hawk	Cottonwood willow galleries next to mesquite woodland. Population increasing in planning area.	PC
Burrowing owl	Open grassland in association with black-tailed prairie dog or kangaroo rat mounds.	PL
Loggerhead shrike	Grassland, open habitats.	PC
Cave myotis	Roosts in large numbers in caves/mines and forages on insects in uplands and over water.	PC
Fringed myotis	Roosts in large numbers in caves/mines and forages on insects in uplands and over water.	PC
California leaf-nosed bat	Roosts in large numbers in caves/mines and forages on insects in uplands and over water.	PC
Mexican long-tongued bat	Roosts may vary from crevices to caves, usually small numbers. Forages on nectar from agaves and other plants.	PC
Huachuca golden aster *(Heterotheca rutteri)*	Open grassland, disturbed and undisturbed sites. Documented at one locale within planning area but much more potential habitat exists.	PC
Needle spined pineapple cactus (*Echinomastus [= Neolloydia] erectocentrus* var *erectocentrus*)	Open sites dominated by desert grassland, chaparral, or mixed shrub vegetation on soils derived from limestone alluvium.	PL

PC = Presence Confirmed. PL = Presence Likely.

Three transects were surveyed and rated suitable for potential reintroduction. One transect was along Cienega Creek and two were in Fortynine Wash. The planning area was considered to be the best of several potential reintroduction sites in Arizona.

Bald Eagle

The bald eagle was recently down-listed from endangered to threatened. Adult bald eagles are large birds with white heads and tails. Immature bald eagles are dark brown with varying degrees of white molting. Their feet and legs are bare of feathers. Bald eagles require large trees, snags, or cliffs within 13 miles of water for nesting, with abundant fish and waterfowl for prey. Fish is their main food source, but waterfowl, small mammals, and carrion are also important food items for breeding, wintering, and transient eagles. Bald eagles breed and migrate through northern and central Arizona, but mainly winter and migrate in southern Arizona.

The planning area does not provide suitable habitat for bald eagles because it lacks large riverine, lake, or reservoir habitats which provide prey species and nesting substrates. Although transient bald eagles occasionally may

visit the planning area, regular visits are considered unlikely.

Southwestern Willow Flycatcher

The Southwestern willow flycatcher is a federally listed endangered species. It is a small, migratory, and riparian obligate bird that nests along rivers, streams, and other wetlands, where dense growths of willow, buttonbush, boxelder, tamarisk, or other plants are present, often with a scattered overstory of cottonwood and/or willow. This species is an insectivore, foraging within and above dense riparian vegetation, taking insects on the wing or gleaning them from foliage (USFWS 1993b).

Southwestern willow flycatchers begin arriving on breeding grounds in late April and May. They begin nesting in late May and early June and fledge young from late June through mid-August. They nest in thickets of trees and shrubs 13 to 23 feet tall, with a high percentage of canopy cover and dense foliage from 0 to 13 feet above ground. The plant community at nest sites is typically even-aged, structurally homogeneous, and dense (USFWS 1993b). The Southwestern willow flycatcher is one of four bird species named as low-elevation riparian priority species in the Arizona Partners in Flight Bird Conservation Plan (Latta et al. 1999).

In 2000, BLM completed an inventory of Southwestern willow flycatcher habitat along Cienega Creek and Empire Gulch. The inventory found four miles of Cienega Creek having suitable habitat and 9.5 miles of Cienega Creek and Empire Gulch having potential habitat (See Appendix 3, Willow Flycatcher Habitat Assessment and Surveys). Much of the potential habitat consisted of relatively even-aged stands of willows that had matured to the point where they lacked sufficient density of understory vegetation. Some type of disturbance to open up these areas to new growth is probably needed to return them to suitable habitat, which is an earlier successional stage.

In the 2001 breeding season, the BLM contracted for willow flycatcher surveys using established protocols along the suitable reaches of Cienega Creek. These surveys detected the presence of one breeding pair along Cienega Creek which successfully fledged at least one young (BLM files).

A volunteer bird-banding project captured migrant willow flycatchers in 1988, 1989, 1990, 1992, and 1993 along the Agricultural Field portion of Cienega Creek (under Master Permit 29108). The project captured no willow flycatchers in breeding status. And willow flycatcher surveys using established protocols along several reaches of Cienega Creek in 1994 found none of these birds (See Appendix 3) . The Agricultural Fields section of Cienega Creek (Segment 59I) was re-surveyed in 1998-2000 for a stream restoration project, but again no willow flycatchers were detected.

Chiricahua Leopard Frog

The Chiricahua leopard frog is proposed for federal listing as a threatened species. It is a medium-sized frog from 2.5 to 4 inches long having on the rear of its thigh a distinctive pattern of small, raised, cream-colored spots or tubercles on a dark background. These frogs occur in Santa Cruz, Apache, Gila, Pima, Cochise, Greenlee, Graham, Yavapai, Coconino, and Navajo counties at elevations from 3,000 to 8,300 feet. They inhabit a wide variety of aquatic habitats, including streams, rivers, backwaters, cienegas, ponds, and stock tanks that lack bullfrogs and non-native fish. They prefer habitats with permanent water. Adults are typically active from April until November, often breeding after seasonal rains (USFWS 2000; Stebbins 1966).

Like other leopard frogs, Chiricahua leopard frogs have experienced alarming declines in recent years. Surveys from 1983 through 1987 found Chiricahua leopard frogs in only 2 of 36 sites where the species had previously been recorded (Clarkson and Rorabaugh 1989). The species can be described as declining, low in number, and limited to a few locations. Major threats to the species include predation, possible competition with non-native aquatic species, and loss or altering of aquatic habitats (USFWS 2000).

Both lowland and Chiricahua leopard frogs have been found in several locations in the planning area including: Cienega Creek, Empire Gulch, Mattie Canyon, and off-channel ponds (BLM files; Rosen 1996). BLM biologists routinely captured leopard frogs (tadpoles and adults) while surveying aquatic habitats and sampling fish in Cienega Creek during the early 1990s. Since that time leopard frogs have been found much less often although habitat for both species has increased in Cienega Creek within the last ten years.

Gila Topminnow and Gila Chub

The Gila topminnow, a federally listed endangered species, is a small fish (less than two inches long) inhabiting river basins in Arizona, New Mexico, and Sonora, Mexico. This fish typically inhabits lower elevation (below 1,500 m.) springs, streams, and the margins of larger water bodies, where it shows an affinity for emergent or aquatic vegetation. The species tends to congregate in shallow waters or near the surface of deeper ones. Where cold temperatures occur regularly, Gila topminnows are generally restricted to waters that do not freeze, such as, constant-temperature springs or areas fed or influenced by these springs (Schoenherr 1974).

Gila topminnows feed on organic detritus, algae, and other plants and on invertebrates, such as, crustaceans and insects including the larvae of mosquitos. They give birth to live young. The number of young varies with the fluctuating habitat conditions and size of the adults (Schoenherr 1974)

A candidate for federal listing, the Gila chub is a large minnow that grows as large as 7-8 inches long. Gila chub feed on small insects, small fish, and algae, and occupy smaller streams and cienega-type habitats. They are a highly secretive fish and live in deeper water or near cover (Griffith and Tiersch 1989).

Gila chub are found only in the Gila River basin and historically occurred in springs and small streams in Arizona, New Mexico, and Sonora. Today, they are found in fewer than 15 streams in central and southern Arizona and are abundant at no more than 10 of these locations (Griffith and Tiersch 1989).

Considered the finest remaining natural habitat for the endangered Gila topminnow, Cienega Creek was classified as Category 1 habitat by the Arizona Game and Fish Department (Simons 1987). Cienega Creek also has one of the largest remaining populations of Gila chub. Cienega Creek is particularly significant in that it has no exotic fish species. Recent expansions of bullfrogs within the watershed and their presence in Cienega Creek are raising concerns about possible impacts to native fish and leopard frogs.

Fish inventories of Cienega Creek and its tributaries, Mattie Canyon and Empire Gulch, have been conducted since 1989 by seining, electrofishing, and visual observation. Topminnow populations vary widely from season to season and year to year. In 1989, the estimated fall population of Gila topminnow was 2.5 million, conservatively (Simms and Simms 1992).

Upper Cienega Creek above Gardner Canyon is relatively isolated from large sediment loads and large floods. Thermal fluctuations along this reach are moderated by incoming groundwater which adds a stable temperature to the surface flow. Nonetheless, topminnow populations fluctuated greatly. Topminnow density ranged from 0.5 to 101 per 10 ft^2 during 1989-1997, but was generally above 20 fish per 10 ft^2 (Table 3-18). The reduction of topminnow numbers in the fall of 1993 was most likely a result of intense flooding, estimated to have exceeded a 100-year flood.

In Cienega Creek below Gardner Canyon sediment input and flood flows increase. Habitats fluctuate more and pools seem transient. Thermal conditions are more variable except at the confluence with Mattie Canyon where groundwater moderates the fluctuation in water temperatures. Topminnow densities fluctuate greatly. The number of topminnow ranged from 0.82 to 18 per 10 ft^2 (Table 3-18). The unusually cold winter of 1989/1990 may have greatly reduced topminnow numbers in Lower Cienega Creek. Five sites were compared in the fall of 1989 with those in the late winter of 1990. The Headwaters site showed a 303% increase in topminnow numbers from fall to late winter. The other sites showed an 87-99% decrease in topminnow numbers. Observations over two winters found that topminnows suffer substantial mortality when temperatures fall below 10°C. At Headwaters Spring, the warmer groundwater during the harsh winter may have provided a refugium for the Gila topminnow. Topminnow numbers similarly declined in 1993, when extreme flooding for more than a week scoured the lower reaches of Cienega Creek. Flooding reduced the Cienega Creek topminnow population in the upper creek, but the upper creek still had densities 10 times that of the lower creek. The composition of the fish community in Cienega Creek varies from its upper to lower reaches as well as from year to year. Topminnow make up more than 90% of the fish community in some years, but averaged 78% during the 8 years of record. Longfin dace composed up to 57% of the fish community with an average of 21% (Table 3-19). Fish sampling is difficult in Cienega Creek because of the large volume of vegetation cover, great pool depths, and undercut banks. Seining data reflect only the relative abundance for two fish species because Gila chub are effectively captured only by electrofishing. But seining did produce a substantial number of juvenile chub (<90mm TL), showing that these fish are reproducing at an acceptable level for recruitment (Table 3-19). Visual observations and electrofishing data show that a large population of adult Gila chub occupies all perennial segments of Cienega Creek. Visual observations of adult Gila chub. made for the aquatic habitat inventory in 1989-1990 found 368 chub along the perennial length of Cienega Creek. This estimate is undoubtedly low due to water turbidity in some reaches, vegetation cover, and the secretive nature of Gila chub.

Mattie Canyon supports typical riffle-pool type habitat with large numbers of longfin dace and Gila chub. Gila topminnow occur in small localized groups and are generally uncommon in this tributary.

Empire Gulch supports a marsh habitat with a few large, deep pools that support mud turtles and leopard frogs. Gila topminnow have also been recorded in Empire Gulch near its confluence with Cienega Creek. Although isolated from Lower Empire Gulch by several miles of dry streambed, except during flooding, Upper Empire Gulch Spring has been found to have suitable habitat for reintroducing Gila topminnow. An environmental analysis is being completed for a reintroduction effort.

Table 3-18
Population Trend Data Collected During 1989-1996 for Gila Topminnow
Along Upper and Lower Cienega Creek

Upper Cienega Creek (above Gardner Canyon)				Lower Cienega Creek (below Gardner Canyon)			
Year	x̄/10ft²	Range	# Sites	Year	x̄/10ft²	Range	# Sites
1989	21.2	--	1	1989	10.90	0.04-29	5
1990 W	58.5	2.80-114.0	2	1990 W	1.10	0.00-6.5	12
1990 F	0.5	--	1	1990 F	4.10	3.80-4.4	2
1992	101.5	--	1	1992	18.00	0.80-26.2	3
1993	10.2	6.40-13.9	2	1993	0.82	0.00-3.6	6
1994	31.7	0.78-62.0	2	1994	7.10	1.40-20.2	6
1995	53.2	13.8	2	1995	11.20	0.08-33.0	5
1996	No Data	--	--	1996	10.90	2.10-18.1	6
1997	15.8	9.5-22.0	2	1997	--	--	--

Trend from catch per unit area, one pass seining, at several sample sites. Only pool and glide habitats sampled. Sampled in fall except for 1990, which was sampled in late winter (W) and fall (F).

Table 3-19
Relative Abundance of Fish Collected During 1989-1997 for Cienega Creek, Pima County, AZ

Cienega Creek Seining Data					
		Percentage of Fish Community			
Year	**# Sites Sampled**	**Gila Topminnow**	**Longfin Dace**	**Gila Chub - Mainly Juveniles**	**TOTAL**
1989	6	92.0	7.6	0.4	**100**
1990W	12	78.5	21.4	0.1	**100**
1990F	3	75.5	24.4	0.1	**100**
1992	4	86.4	13.5	0.1	**100**
1993	8	41.6	57.5	0.9	**100**
1994	8	82.5	16.4	0.1	**100**
1995	7	91.4	8.1	0.5	**100**
1996	7	78.4	21.2	0.4	**100**
MEAN% (Std.Dev.)		78.4 (16)	21.3 (16)	0.3 (0.3)	**100**

Seining data based on multiple passes until site was depleted. Only pool and glide habitats were sampled. Sampled in fall except for 1990 when sampled in late winter (W) and fall (F).

Cinco Canyon has seven natural ponds, five of which are perennial. These shallow ponds do not support fish but do support Sonoran mud turtles, breeding rails, breeding ducks, and leopard frogs. The ponds have been proposed as potential reintroduction sites for Gila topminnow.

In 1988 the Arizona Game and Fish Department reintroduced Gila topminnow into Nogales and Little Nogales Springs near Wakefield Canyon, another tributary to Cienega Creek. These transplants appear to have failed, but these springs still provide habitat for future reintroductions (Weedman and Young 1995).

Desert Pupfish

The desert pupfish, federally listed as endangered, is a small (1.5 inch long) desert fish that inhabits springs, seeps, shallow pools, and backwaters in the Colorado River and Rio Sonoyta drainages (Schoenherr 1988; USFWS 1993a). Pupfish feed on small crustaceans, insects, and other invertebrates; worms; mollusks; aquatic macrophytes and algae; and detritus. These fish reproduce when water temperatures exceed 20°C. Males are territorial and may spawn with several females. Desert pupfish only inadvertently care for their eggs and young as a result of their relentless habit of driving out other male pupfish and other fish species from their territories.

One reintroduced population is present in a pond on private land within the planning area. Pupfish are being considered for possible reintroduction in the planning area, but no specific sites for reintroduction have been evaluated.

Special Status Fish and Wildlife Habitat Conditions and Inventory

BLM has not conducted specific surveys or evaluated habitat conditions for many of the Arizona wildlife of special concern or recently listed BLM sensitive species that occur or are likely to occur in the planning area. Studies by other agencies or independent researchers have produced information on occurrences or habitat for some of these species. (Appendix 3, Special Status Species Summaries, briefly summarizes the habitat requirements and distribution of these species).

Lowland Leopard Frog, Mexican Garter Snake, and Longfin Dace

Occurrence data and some habitat data for lowland leopard frog and Mexican garter snake (both Arizona wildlife of special concern) and long-fin dace (BLM sensitive) have been collected during the surveys and habitat monitoring for Gila topminnow and Gila chub (BLM files).

Yellow-Billed Cuckoo

The yellow-billed cuckoo is an Arizona wildlife of special concern and is one of four bird species named as low-elevation riparian priority species in the Arizona Partners in Flight Bird Conservation Plan (Latta et al. 1999). Surveys for yellow-billed cuckoo were conducted along portions of Cienega Creek in 1998-1999 (Corman and Magill 2000). In 1998, 14 pairs of cuckoos were detected along 14 km of survey, representing 19.2% of Arizona's population of cuckoos. In 1999, 12 pairs of cuckoos were detected along 15 km of survey, representing 7.3% of Arizona's population of cuckoos.

Gray Hawk

The gray hawk is a BLM sensitive species that nests in cottonwood-willow riparian areas next to dense patches of mesquite woodland. BLM biologists surveyed raptor nests along Cienega Creek and Empire Gulch in 1989 and 1991. One pair of nesting gray hawks was detected during these surveys and since then has been confirmed to nest in the same general area every year. In 1999, three pairs of nesting gray hawks

were detected showing an expansion in the breeding population (BLM files).

Baird's Sparrow and Grasshopper Sparrow

The Baird's sparrow and Arizona grasshopper sparrow are both Arizona wildlife of special concern and are two of the six bird species named as desert grassland priority species in the Arizona Partners in Flight Bird Conservation Plan (Latta et al. 1999). Populations of both species are in serious decline in the United States. The Arizona grasshopper sparrow is a local breeding race with a very limited breeding distribution in southeast Arizona. The population is supplemented with individuals from northern subspecies during winter. Baird's sparrow has undergone statistically significant declines in population in the last 30 years (Krueper 2000).

Researchers are studying habitat relationships of both sparrow species at study sites in the planning area. A stable population of wintering Baird's sparrow and a small stable population of breeding Arizona grasshopper sparrows are present at the area's southern end. Enough habitat quantity and quality seem to be present to maintain these populations. Both species seem to tolerate low to moderate grazing within their habitats. But heavier grazing (or even low-to-moderate grazing in drought years) can degrade habitat condition and cause a loss of preferred microhabitats for nesting or thermal cover (Krueper 2000).

Threatened, Endangered and Other Special Status Plants

Although the planning area has a high diversity of plants, only four are considered of special concern for management:

Needle Spined Pineapple Cactus

The needle spined pineapple cactus (*Echinomastus [= Neolloydia] erectocentrus* var *erectocentrus*) is a former Category 2 federal candidate and now a BLM sensitive species found in eastern Pima, southeast Pinal, and Cochise counties. This plant is distributed generally from Vail east to the Little Dragoon Mountains and south to the Mule Mountains. Typically it grows on open sites dominated by desert grassland, chaparral, or mixed shrub vegetation. Most of the planning area north of the narrows appears to be suitable habitat for the species which grows on bajadas and soils derived from limestone alluvium at 3,000 to 5,000 feet in elevation. But no surveys for this species have been conducted (USFWS 1992).

Huachuca Golden Aster

The Huachuca golden aster *(Heterotheca rutteri)* is a BLM sensitive species that grows at 4,000 to 5,000 feet in elevation, almost exclusively in the open grassland. It grows at both disturbed and undisturbed sites with a preference for flat areas. It has been found mainly in the grasslands that abut the Huachuca, Patagonia, and Santa Rita Mountains, and the San Rafael Valley at the headwaters of the Santa Cruz River. In 1997, the Huachuca golden aster was found in the planning area in the West Pasture on the Empire-Cienega allotment. The planning area has much more grassland that is potential habitat for the species, but surveys for the species have not been conducted in these areas (USFWS 1992).

Huachuca Water Umbel

The Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*) is federally listed as endangered. It is a herbaceous semi-aquatic perennial with slender pale green erect leaves growing from nodes of creeping shallow rhizomes, which branch freely and may form dense mats making individual plants hard to distinguish. Tiny flowered umbels arise from root nodes. The flowers are 1 to 2 millimeters

wide with tiny maroon-tinted petals. Flowering has been observed from March through October (USFWS 1997b).

The Huachuca water umbel requires perennial water, gentle stream gradients, small to medium sized drainages, and apparently mild winters. It is usually found in water from 2 to 16 inches deep. A moderate flood frequency and the associated level of disturbance to other plant species are required to maintain the ecological niche for this species. But floods that are too frequent or intense can destroy populations. These plants are found in both unshaded and shaded sites. Associated plants include willows, alder, cottonwood, cattails, bulrushes, sedges, rushes, grasses, and watercress (USFWS 1997b).

The Huachuca water umbel has been found in Empire Gulch near its confluence with Cienega Creek **and in Cienega Creek near the confluence with Empire Gulch**. Potential habitat for the species is also found along Cienega Creek and Mattie Canyon.

Canelo Lady Tresses Orchid

The Canelo lady tresses orchid (*Spiranthes delitescens*) is a newly described species that, because of its rarity, has been federally listed as endangered. It is known only from three locations in Santa Cruz and Cochise counties in the San Pedro watershed. The orchid has linear-lanceolate grass-like leaves and a flowering stalk that is about 50 cm tall. The flower stalk contains about 40 white flowers positioned in a spiral at the top of the stalk. This orchid flowers from late July to early August when temperatures range from 60°F at night to100°F during the day. During that time, precipitation averages 15 to 20 inches (USFWS 1997b).

Canelo Hills lady tresses grows in cienegas and needs finely grained, highly organic, saturated soils. It is found intermixed with tall grasses and sedges at about 5,000 feet in elevation. The associated plant species include *Bidens*, *Carex*, *Juncus*, *Eleocharis*, *Typha*, and *Equisetum*. This species has not been found in Cienega Creek but does occur in other drainages nearby (USFWS 1997b).

VISUAL RESOURCES

Visual resource management (VRM) is a process BLM uses to identify and manage scenic quality and to reduce the impact of development on the scenery. The VRM system does the following:

- Evaluates the quality of existing scenery.
- Considers the distance from which that scenery is viewed.
- Looks at people's sensitivity to changes in the landscape.

To manage visual resources, management classes have been developed to describe the degree of landscape modification permissible (See Appendix 2, Visual Resource Management Classes).

Most of the Empire-Cienega Planning Area falls into a VRM Class II which describes a landscape that is largely unmodified and scenic. Highway 83, which runs along the planning area boundary and crosses the planning area for 2 miles, is a designated scenic route in Arizona's State Highway System. The viewshed or scenery from Highways 82 and 83 and the main ranch road includes undisturbed panoramas of rolling grasslands with an average elevation of 4,500 feet against the dramatic backdrops of the mountain sky islands of Coronado National Forest: the 9,400 foot summit of Mt. Wrightson in the Santa Rita Mountains to the west and the 7,700 foot summit of Apache Peak in the Whetstone Mountains to the east; to the

southeast is the distinctive hump of 6,300-foot Biscuit Mountain in the Mustang Mountains; to the north and south are the more gentle vistas of the Empire Mountains and the Canelo Hills.

The riparian vegetation of Cienega Creek and oak woodlands in other drainages create a dramatic green belt that magnifies the overall scenic quality of the rolling grass and oak- and agave-covered hills and offers sharp contrast to nearby views of desert scrub. Along Cienega Creek, however, is a limited area that farming has visually degraded.

Some vantage points along the interior roads of the planning area reveal arroyo cutting, abandoned water diversion structures, a 0.25-mile-long abandoned dirt airstrip, heavily trampled livestock watering holes, badlands topography, old dumps, and cut mesquite bosques. But these features do not detract from the planning area's overall scenic quality.

A one-mile segment of Empire Gulch near the historic Empire Ranch headquarters consists of a visually spectacular Fremont cottonwood gallery forest. Views from the historic ranch house, especially the breezeway and bay window, are generally unspoiled except for the Doplar radar tower in the Empire Mountains and the abandoned airstrip, which is occupied 5 to 10 times a year with small (1-20 vehicles) to large (20-70 vehicles) groups for periods of up to two weeks.

PALEONTOLOGICAL RESOURCES

Although no vertebrate fossil sites have been found in the planning area, several are located nearby. The fossilized remains of a previously unknown dinosaur species, *Sonorasaurus thompsoni,* were recently found near Sonoita. The bones of a late Pleistocene elephant have been reported in the Elgin School locality. And the remains of a Pleistocene horse were documented in the Empire Mountains. Similar sites may exist in the planning area. The planning area may also have invertebrate fossil deposits.

CULTURAL RESOURCES

In this plan the term cultural resources refers to nonrenewable remnants of the human past and definite locations of traditional cultural or religious importance to specific cultural groups.

Cultural resources documented in the planning area proper consist mainly of prehistoric, protohistoric, and historic archaeological sites and historic structures representing four cultural groups: Archaic/Early Agricultural, Hohokam, Sobaipuri, and Anglo-American. Cultural resources that are documented at nearby sites and that may exist in the planning area represent four other cultural groups: Paleo-Indian/Clovis, Apache, Spanish, and Mexican.

HUMAN OCCUPATION AND CULTURAL PROPERTIES

Paleo-Indian/Clovis (ca. 10,000 B.C. to 5,500 B.C.)

To date, no evidence of Paleo-Indian/Clovis presence has been recorded in the planning area. But the bones of a late Pleistocene elephant recorded at a site near Elgin and those of a Pleistocene horse found in the Empire Mountains suggest that the types of big game animals killed by Clovis hunters in the nearby San Pedro Valley could have inhabited the planning area. If Clovis people did visit the planning area, it may have been at about the same time that they were hunting Pleistocene animals in the San Pedro Valley.

Archaic/Cochise/Early Agricultural (ca. 5,500 B.C. to A.D. 200)

Archaeologists do not know when humans first appeared in the planning area. The oldest evidence to date of human habitation in the planning area was recovered from two late Archaic pithouse village sites during excavations by archaeologists from the University of Arizona and the Arizona State Museum. Carbon-14 dating reveals that these sites were inhabited about 3,500 years ago by people who cultivated maize, squash, and beans. These foods supplemented a diet based on collected food products from wild plants, such as agave, lambs' quarters, amaranth, prickly pear, Emory oak, and mesquite, and on a variety of game, such as deer, pronghorn, bighorn sheep, and rabbits (Eddy and Cooley 1983; Huckell 1990).

Many other Archaic sites have been documented in the planning area but none have been dated. Some may represent an early Archaic culture known in southern Arizona as the Cochise. The Cochise based their subsistence on hunting and gathering and may have been among the earliest people in the Southwest to cultivate maize (corn). The Archaic sites in the planning area may provide important information about the transition from economies based on hunting and gathering to cultivation of domestic plants (Bronitsky and Merritt 1986; Eddy and Cooley 1983; Huckell 1990; Reid and Doyle 1986; Swanson 1951).

Hohokam (ca. 300 B.C. to A.D. 1450)

Archaeologists do not agree on the origin of the Hohokam culture. Some argue that this culture was a transformation from the late Cochise and occurred in the deserts and river valleys of southern Arizona and northern Mexico. Others maintain that the Hohokam culture was brought into Arizona during a rapid migration of people from northern Mexico. The Hohokam based their economy on cultivating maize, beans, and squash, and "encouraged" some wild plants such as agave, yucca, lambs' quarter, panic grass, and amaranth to grow by tending them much as they did their domestic crops. Rounding out the Hokokam diet were such game meat as deer, pronghorn, bighorn sheep, and rabbits and such wild plant foods as mesquite pods, cholla buds, and a variety of seeds.

Many Hohokam habitation and resource use sites have been documented in the planning area. Cultural materials found at these sites show that the Hohokam were present by around A.D. 500 and that they cultivated crops of maize and bean along the planning area's streams. They also harvested wild plant foods in both riparian and upland areas and hunted local animals and birds. Hohokam farmers in the planning area may have arranged systematically placed rock circles around the base of individual agave plants to collect and conserve water. Agave hearts were roasted in pits and then eaten. We do not know how long the Hohokam lived in the planning area (Bronitsky and Merritt 1986; Eddy and Cooley 1983; Huckell 1990; Reid and Doyle 1986; Swanson 1951).

Sobaipuri (ca. A.D. 1450 to 1770)

Pottery sherds tentatively identified as being of Sobaipuri origin have been found at several sites in the planning area. These sherds may represent pottery made by Sobaipuri who actually lived at these sites. Or, these sherds may be fragments of vessels acquired from Sobaipuri living elsewhere and brought to these sites by late Hohokam inhabitants. Jesuit Father Eusebio Kino's journals describe a Sobaipuri settlement of about 500 people established in 1698 near the headwaters of Sonoita Creek, a few miles southeast of the planning area. The Jesuits referred to this settlement as Los Reyes de Sonoitac. In 1951, Charles Di Peso

excavated a Sobaipuri habitation site a short distance south of the planning area. Whether Sobaipuri Indians from these settlements were somehow involved with sites in the planning area is not yet known.

During the Spanish colonial period several Sobaipuri villages were located along the San Pedro River and the lower reaches of the Babocomari River. By the early 1770s, Apache raids had forced most Sobaipuri to relocate to the Santa Cruz Valley.

Sobaipuri subsistence was based on cultivating domestic plants, collecting wild plant foods, and hunting. The Sobaipuri readily accepted livestock, domestic plants, and agricultural innovations introduced to them by Father Kino and later Spaniards (Bronitsky and Merritt 1986; Bolton 1948; Di Peso 1953; Seymour 1989; Sheridan 1995).

Western Apache (ca. A.D. 1693 to 1873)

The planning area lies in what was once territory claimed by the Western Apache Indians. One of the earliest historic references to the Apache dates to 1541. At that time Spanish explorers found living on the southern plains of New Mexico a nomadic people to whom they referred collectively as the Querecho. Later these people became known as the Apache.

Before the Pueblo Indian revolt against the Spanish in 1680, most Indians in the Southwest had only limited access to horses. During the revolt the Pueblos took thousands of horses from the Spaniards. Many other horses escaped into the wilds where they were captured by Indians. After the revolt, many Indian tribes, including the Apache, rapidly adapted the use of horses into their cultures. With horses the Apache became highly mobile and rapidly expanded their territories.

Father Kino's records mention the appearance of Apaches north of the present day Gila River in 1693. Historic documents thereafter refer often to the Apaches, including the Aravaipa band of the Western Apache. South of the Gila River this band roamed over a wide swath of land that included the Empire, Cienega, and Sonoita valleys. The economy of the Western Apaches was based on nomadic, seasonal hunting and gathering and some plant cultivation. Because the Apache moved campsites often and did not establish permanent settlements, sites that they occupied tend to be ephemeral and difficult to find. No sites in the planning area have been recognized as being of Apache origin. But the probability is high that the Apache hunted, collected wild plant foods, and camped in the planning area and that sites representing these uses will eventually be found (Basso 1971; Bronitsky and Merritt 1986; Sheridan 1995).

Spanish Colonial (ca. A.D. 1691 to 1821)/Mexican (ca. A.D. 1821 to 1854)

Although mining and ranching potential attracted interest, hostilities with the Apaches discouraged both the Spaniards and Mexicans from establishing permanent settlements in the planning area. Several land grants existed nearby, but no historic records have been found to show that land in the planning area was part of any formal Spanish or Mexican land grants. We do not know whether Spanish or Mexican cattle grazed in the planning area.

Father Kino's narratives state that in 1699 he took 150 head of cattle to the Sobaipuri settlement at Los Reyes de Sonoitac, where the Jesuits had established a "visita," later known as San Ignacio de Sonoitac. Sometime after 1759 the Jesuits built a small church there. Records do not show that this venture developed into a successful cattle-raising operation. In 1825, Don Leon Herreras, a prosperous ranchero

living in Tubac, obtained the San Jose de Sonoita Land Grant which covered more than 8,000 acres around Kino's "visita." In 1832, Ignacio and Doña Eulalia Elias, citizens of Royon and Arispe, respectively, obtained the San Ignacio del Babocomari Land Grant which covered more than 34,000 acres south of the planning area. Both grants later went through a succession of ownerships (Bolton 1948; Di Peso 1953; Officer 1987; Sheridan 1995; Wagoner 1952; Wilson 1995).

Anglo-American (ca. A.D. 1854 to present)

The first Anglo-Americans to take up land near the planning area began arriving after the Gadsden Purchase was ratified in 1854. Their numbers increased gradually after the National Homestead Act was passed in 1862 and the American Civil War ended in 1865. By the early 1870s, demand for beef by the military, mining settlements, and Indian reservations encouraged homesteading and the establishing of many small ranches in the Empire, Cienega, and Sonoita valleys. Droughts, rustling, and Apache raids caused many to fail. The Empire Ranch is among those that did survive and prosper well into the 20th century.

A 160-acre homestead owned by William Wakefield formed the nucleus of the Empire Ranch. Wakefield sold the land to Edward N. Fish and Simon Silverberg in June 1876. In August 1876, Fish and Silverberg sold the homestead to Walter L. Vail and Herbert S. Hislop. Both were in their mid-20s and had come to Arizona searching for land on which to establish a partnership cattle ranch. In October 1876, John N. Harvey joined the partnership, bringing capital for purchasing more land and livestock. Both Hislop and Harvey were from England and Vail's family had settled in Nova Scotia before emigrating to New Jersey. Locally, the trio's ranch became known as the "English Boys' Outfit." Hislop sold his shares to Vail in 1878. Vail and Harvey continued to acquire neighboring land until the ranch extended some 60 miles from north to south and 30 miles east to west. In 1881, Harvey sold his shares to Vail who continued to develop and expand the business. Historic land records show that Vail bought out many homesteaders along Cienega Creek. When he died in 1906, the ranch covered almost 1 million acres.

In 1928, Frank S. Boice, Chairman of the Chiricahua Cattle Company, bought the Empire Ranch from the Vails. The Boices became well known in the Southwest for the purebred Hereford cattle they produced at the Empire Ranch. In 1969, the Boice family sold the ranch to Gulf American Corporation for a proposed real estate development which did not occur. Anamax Mining Company next bought the ranch lands for their mineral and water potential but did not develop these resources. A series of land exchanges in 1988 placed the land into public ownership under the BLM's administration as the Empire-Cienega Resource Conservation Area.

In November 1876, Hislop wrote a letter to his sister in London, England, stating that the small holding was called the Empire Ranch when he and Vail bought it and that an unfinished, four-room adobe house with an attached corral was included in the purchase (Fontana 1965). Exactly when this house was built has not yet been determined. Sawn lumber used as roof beams may have been cut at a nearby mill owned by Fish. Tree-ring dates from these beams may eventually provide an estimate as to when the house was built (Collins 1996; Dowell 1978; Fontana 1965; Pickrell 1961; Sheridan 1995; Soulliére-Harrison and Neidinger 1995; Stein 1990; Wagoner 1952; Wilson 1995; Zook 1994).

As his family and staff grew, Vail enlarged the house. By the late 1890s, it contained at least 20 rooms and covered about 9,000 square feet of living space. Remodeling projects between 1900 and the late 1950s included the following:

- Adding gabled roofs, wooden shingles, and rolled roofing.
- Applying cement stucco to both interior and exterior walls.
- Installing electrical wiring and plumbing, propane and natural gas heating, sheet rock ceilings, carpeting, wood paneling, a large picture window, and wood and cement floors.

Today, the house exhibits architectural features and home furnishing styles popular in rural Arizona between the territorial settlement period and post World War II. The Empire Ranch House is listed on the National Register of Historic Places.

Between 1876 and the mid-1890s, a cluster of buildings was placed around the ranch house forming the ranch headquarters. Other structures were built in the 1940s and 1950s. These buildings include: three houses, an adobe barn, a tack shed, a horse barn, a grain shed, a machine shop, and a manger and stalls. A small swimming pool was built in 1939 or 1940. These buildings are eligible for listing on the National Register of Historic Places, possibly as a rural landscape. A brick house built north of the ranch in the 1960s would probably not meet the criteria for listing on the National Register. But this house would figure importantly in maintaining the integrity of the landscape and adaptive reuse (Soulliére-Harrison and Neidinger 1995; Stewart 1970; Zook 1994).

The planning area has been used in historic times mainly for ranching and farming. A variety of livestock ranching structures and sites are dispersed around the area. This inventory includes: corrals, several cabins, short-term camps, windmills, and watering tanks. Letters written by Walter Vail state that each year he hired Mormon farmers from Benson to cut hay at fields near Cienega Creek. Vail fed the hay to his horses and other livestock kept at the ranch headquarters. The farmers camped near the hay fields. Evidence of these camps may still exist (Dowell 1978).

Mining History

From 1880 to 1885, Walter Vail and partners profitably operated the Total Wreck Mine at the northern end of the planning area. At its peak, this mine yielded more than 50 tons of silver ore per day. Equipped with twenty 950-pound stamps and 14 amalgamation pans, the Total Wreck mill could process from 65 to 70 tons of ore per day.

Today, the mine is privately owned but not operating. The remnants of Total Wreck City, a settlement of about 300 people that grew up around the mine, are on adjacent Arizona State Trust Land. The settlement included more than 50 houses, three hotels, a brewery, four saloons, and several Chinese laundries. Walter Vail's brother Edward operated a butcher shop supplied with beef raised on the Empire Ranch. Remnants of a system used to pump water from Cienega Creek to the mine lie within the planning area (Dowell 1978).

Railroad History

A 4.5-mile segment of the historic Atchison, Topeka, and Santa Fe Railroad line crossed the northern end of the planning area. Construction of the Santa Fe Railroad through southern Arizona in the early 1880s provided a means to haul supplies and freight into the region and beef and ore out to distant markets. The railroad was a primary contributor to the development

and success of ranching and mining in the Empire, Cienega, and Sonoita valleys. The railroad hauled thousands of cattle raised on the Empire Ranch to pastures and markets in California and Kansas. The railroad also shipped silver ore from the Total Wreck Mine to New York (Dowell 1978; Sheridan 1995).

Military History

Between 1856 and the mid-1880s, U.S. Army cavalry troops regularly patrolled the Empire and Sonoita valleys. Many skirmishes with Apaches in the general vicinity of the planning area are documented. According to Hislop's and Vail's letters, cavalry troops sometimes camped near the Empire Ranch headquarters, and both men visited with the officers. Among the first army troopers who patrolled the area were those stationed at Fort Buchanan, which was built at the headwaters of Sonoita Creek in 1856 (Dowell 1978; Fontana 1965; Sheridan 1995).

NATIVE AMERICAN LOCATIONS OF TRADITIONAL CULTURAL AND RELIGIOUS IMPORTANCE

To date, no Native Americans have named any locations of traditional cultural or religious importance in the planning area. The Tohono O'odham claim ancestral affiliation with the Hohokam and Sobaipuri Indians who inhabited the planning area and surrounding land. The Hopi Indians also claim affiliation with the Hohokam and Sobaipuri. The Hopi include most of Arizona in their oral tradition about ancestral migration routes. San Carlos Apache elders have expressed interest in the planning area, but have not yet named any specific resources or locations.

Both the Tohono O'odham and the San Carlos Apaches have expressed an interest in being allowed access to wild plants used for traditional medicinal, ritual, and utilitarian purposes.

The remains of prehistoric Native Americans have been found in the planning area and more will probably be found. When such remains are found, BLM contacts representatives of appropriate Native American groups and arranges for treatment or repatriation according to criteria specified by the Native American Graves Protection and Repatriation Act and the Archaeological Resources Protection Act.

LAND USES

LANDS AND REALTY ACTIONS

Rights-of-Way

The Empire-Cienega Planning Area has about 40 recorded easements and rights-of-way for roads, utilities, and other land uses. BLM acquired and reserved these easements and rights-of-way with its acquisition of the Empire-Cienega property on June 8, 1988. More recent roads and utility lines have been developed to service structures and facilities but are not recognized as rights-of-way because they benefit BLM and its lessees.

Major Utility Lines

Electrical transmission and communication rights-of-ways cross public lands in the following areas:

T.18 S., R. 17 E., Sec. 12; Tucson Electric Power Co.

T.18 S., R.18 S., Sec. 7 and 19; Arizona Electric Power Co.

T. 19 S., R. 18 S., Sec. 5 and 9; Tucson Electric & Arizona Electric

The right-of-way widths for these easements are about 100 feet each. Neither electric company has any immediate plans or proposals to install new or more electrical lines.

A privately owned El Paso gas line easement runs through federal lands in the following areas:

T. 19 S., R. 17 E., Sec. 7, 18, 19, 30

T. 19 S., R. 16 E., Sec. 25

Owned by the El Paso Natural Gas Company and conveyed to El Paso before BLM acquired the Empire-Cienega property, this private easement is 60 feet wide. El Paso Natural Gas has no plans to install any other new lines within its private easement. Should a new gas line be needed in the future, El Paso will have to cross BLM lands next to its easement to install, maintain, and access the new line.

No other major utility lines run through any federal lands at the north end of Empirita or near Interstate 10. But throughout the planning area are scattered smaller utility lines that BLM and prior owners installed and granted.

Land Use Permits

In the past, BLM has authorized land use permits in the planning area for uses such as major motion pictures, television commercials and productions, bee hives, and still photography. BLM rarely issues these authorizations, at most, issuing one permit every two years.

Land Tenure

The Land Tenure Amendment to the Safford District Resource Management Plan (RMP) (BLM 1994b) made land tenure decisions for the Empire-Cienega Planning Area while the planning area was administered by the BLM Safford District. The Empire-Cienega Long Term Management Area (LTMA) was one of 24 LTMAs delineated in the Land Tenure Plan Amendment. These LTMAs are analogous to the resource conservation areas (RCAs) established in the Phoenix RMP. The boundaries of the Empire-Cienega LTMA correspond to the current planning area boundary. Management prescriptions for the LTMAs include the following:

- Intensively manage the public lands for their multiple resource values as defined in the Federal Land Policy and Management Act.
- Retain all public land (surface and subsurface estate) and possibly seek to acquire State Trust and private lands within these areas.
- Consider land acquisitions on a case-by-case basis and consider economic as well as natural resource impacts.

Under these prescriptions, BLM may acquire land by exchange or purchase by considering four alternatives for private lands acquisitions:

- Land owner education.
- Entering into cooperative management agreements.
- Partial acquisition such as conservation easements.
- Full “fee simple title” acquisition.

The purpose of the acquisition program is to acquire lands that can improve the area’s resource management and values and enhance the benefits of public use and services. Ongoing land exchanges that would acquire more public lands within the planning area include the

Morenci Land Exchange EIS (ROD, March 1997) and the Dos Pobres/San Juan Project EIS (Volume 2, Appendix BB-B9).

PRIME AND UNIQUE FARM LANDS

Public Law 97-098, the Farmland Protection Policy Act of 1981, authorizes the designating of prime and unique farm lands. BLM has not designated prime or unique farm lands in the planning area. Before BLM acquired the property, land on the Cienega Ranch along Cienega Creek was farmed historically. The Vail family established the farm on the Cienega Ranch around 1900. When the Chiricahua Cattle company acquired the ranch, the farm was leased out and operated until about 1950. The fields were abandoned when Jack Greenway held the property, but were farmed again by Sam Bell in the 1970's. Anamax Mining Company also briefly farmed to maintain agricultural water rights. These agricultural fields have been abandoned (Gerald Korte, Letter to BLM received November 26, 2001).

FLOODPLAIN DESIGNATION

Lands within the planning area might meet the criteria for Pima and Santa Cruz County floodplain and flood prone designations for lands, but these areas have not been delineated. BLM generally avoids floodplains as locations for structures and recreation facilities. Some range improvements, including fences and livestock watering facilities, have been built on floodplains and require regular maintenance.

MINERALS~~ING~~

Mineral Potential

Fluid Minerals

The Empire-Cienega Planning Area is ranked prospectively valuable for oil and gas (Stipp and Dockter 1987). Most of the planning area is underlain by a thick and structurally complex sequence of Mesozoic and Paleozoic sedimentary rocks overlain by Tertiary valley-fill alluvium. The Cretaceous Bisbee Group immediately underlies the Tertiary alluvium and contains black shale which may have hydrocarbon source rock potential. An oil seep is reported to have occurred in T. 18 S., R. 18 E., SW¼ section 15 within the Bisbee Group where it crops out along the eastern margin of the Cienega Basin (Gill 1979). Oil and gas shows have been reported in exploratory wells drilled on the edge of the basin.

The Ted Jones No. 1 Juanita State drilled in section 34, T. 18 S., R 18 E. found several gas shows in shale in Bisbee Group strata. Source rock analysis conducted by the Amoco Production Company concluded that samples from this well have high enough organic carbon content to make a good source rock for gas (Arizona Geological Survey file data.) The Jones et al. Larimore No. 1, drilled near Sonoita (Section 9, T. 20 S., R. 16E.), found oil and gas shows in Cretaceous rocks at a depth of 3,216 feet (Arizona Geological Survey file data). These lines of evidence suggest that the Cienega Basin is a favorable environment for oil and gas.

The planning area is not prospectively valuable for geothermal resources (Witcher et al. 1982.)

Solid Leasable Minerals

Solid leasable minerals (coal, oil shale, tar sands, potash, phosphate, sodium) are not present or potentially present within the

planning area, and there is no record or expression of interest in this resource.

Locatable Minerals

The Empire mining district lies within the Empire Mountains and consists of carbonate replacement deposits and veins associated with Laramide porphyry dikes. Mineralization is spotty and the deposits are small tonnage and high grade, with rich silver ore having been mined near the surface (Keith 1974). Production was from the enriched oxidized portion of the deposits, which are most probably mined out now. Some of the deposits may extend down to the water table and contain zones of sulfide mineralization. Exploration has not been conducted deep enough to test this hypothesis.

Minerals were discovered in the 1870s, ~~and considerable silver~~ **and a considerable amount of silver** was mined in the 1880s and 1890s. Base metals were produced from 1907 to 1964. Total production from the district was 34,500 tons of ore containing lead, zinc, copper, silver, gold, molybdenum, and tungsten. The major producing mine of the district was the Total Wreck Mine which produced 14,000 tons of ore averaging 8% lead, 7 oz./ton silver, and minor copper and gold. The chief ore minerals were cerussite, wulfenite, and cerargyrite.

From the above information, the Empire Mountains appear to have low potential for significant metallic mineral resources. Deposits may be hidden inside the mountains, but these are most likely to be sub-economic.

High-purity limestone deposits are known to occur in the Paleozoic carbonate strata. The Escabrosa Limestone is particularly favorable for high-purity limestone deposits. This formation crops out sporadically in the Empire Mountains in small fault blocks. Limestone has been quarried from State Trust Land on the north side of the Empire Mountains just outside the planning area. Limestone placer claims owned by the Georgia Marble Company occur in section 7, T. 18 S., R 17 E. These claims encompass a subeconomic deposit consisting of a relatively thin bed of marbleized Escabrosa Limestone (Acker 1998). Nevertheless, the Empire Mountains have high potential for high-purity limestone.

Directly west of the planning area is the Greaterville gold placer district. Placer gold was mined from Quaternary gravels in the bottoms of major canyons that dissect the valley-fill alluvium on the east side of the Santa Rita Mountains. The gold-bearing gravels begin near the heads of the east-trending canyons and extend 1.5 to 5 miles downstream but do not appear to extend into the planning area (Cox 1994). The potential for placer gold occurring within the planning area is low.

The most significant metallic mineral resource in southern Arizona is copper. Porphyry copper deposits occur in the Helvetia-Rosemont district in the northern Santa Rita Mountains directly west of the Empire Mountains and in the southern end of the Whetstone Mountains east of the planning area. These deposits form in hydrothermal systems related to emplacement of plutons of granitic porphyry rock. The mineral potential of the Cienega basin remains largely unknown because of the thick covering of alluvium. From a regional standpoint, the basin must be considered as having moderate potential for copper because of the favorable geologic environment and presence of nearby deposits.

Salable Minerals

Sand and gravel and landscape rock are the two major salable mineral commodities that are sold within the Tucson and Sierra Vista market areas. Economic deposits of this type have not been found within the planning area. But the potential for sand and gravel deposits is high

within the drainages and the alluvial valley-fill. No interest in mining sand and gravel has been demonstrated since the planning area became public land although several Arizona Department of Transportation aggregate sources lie along Highways 83 and 82. Distance to major market areas could prohibit developing a mineral material site.

Mineral Rights

Except for an area in the Empire Mountains and several split-estate parcels, the Empire-Cienega Planning Area is closed to mineral entry and mineral leasing pending a formal opening order (Map 3-7). Lands open to mineral entry total about 460 acres in sections 7, 8, 17, and 18 of T. 18 S., R. 17 E and about ~~5,915~~ 7,167 acres of split-estate. These parcels are original public domain lands. The legal descriptions of the split-estate parcels with either state or private surface and federal minerals are in Appendix 3, Split-Estate Parcels. As of May 19, 1998, there were three placer claims in section 7. BLM has issued no mineral leases within the planning area.

BLM manages locatable minerals under the 43 CFR 3809 Surface Management Regulations, oil and gas under the 43 CFR 3100 regulations, and mineral materials under the 43 CFR 3600 regulations. The planning area is closed to mineral material disposal pending resource management plan determinations.

HAZARDOUS MATERIALS

No recognized environmental conditions are known to exist within the planning area. A *recognized environmental condition* is defined as the presence or likely presence of any hazardous substance or petroleum product on the property under conditions that indicate an existing release, a past release, or a material threat of a release into the ground, groundwater, or surface water. An abandoned 1,000-gallon underground fuel storage tank was removed from the Empire Ranch in 1994 to avoid possible contamination.

RANCHING AND LIVESTOCK GRAZING

As a result of the 1988 land exchange that brought the Empire-Cienega lands into public ownership, BLM acquired private lands in portions of five ranches with ongoing livestock operations: the Empire Ranch, the Cienega Ranch, the Rose Tree Ranch, the Empirita Ranch, and the Vera Earl Ranch. In addition to these private lands, BLM also acquired the Arizona State Land Department grazing leases for the Empire, Cienega, and Empirita Ranches. After BLM's acquisition of the private lands, the Empire and Cienega Ranches were combined into one grazing allotment, the Empire-Cienega. The acquired public lands in these four allotments were not covered under an existing land use plan and, therefore, grazing management allocations and prescriptions are being developed for them in this plan (Map 3-8). The Rain Valley allotment is also within the planning area boundary. The Rain Valley allotment includes 160 acres of public domain lands but is mostly private and State Trust Land.

The Rain Valley allotment is covered under the Safford District Resource Management Plan (BLM 1991) and grazing impacts for the allotment were analyzed in the Eastern Arizona Grazing EIS (BLM 1986). Therefore, management prescriptions for this allotment are not included in this plan. In 1988, BLM also acquired, in the Empire Mountains, 2,000 acres of private lands that did not have valid existing grazing leases at the time of transfer. Since

Map 3-7
Surface Management Status & Subsurface Management Status

acquiring these lands, BLM has been approached by people wanting to establish a new grazing allotment in the Empire Mountains. The proposed allotment includes acquired lands, original public domain lands, and private lands. Most livestock operations in the Sonoita area are year-long operations, raising calves from a base herd of cattle for marketing. The ranches usually consist of a mixed ownership of private, State Trust, national forest, and BLM-administered lands. Although the operations are year long, they may only seasonally use the federal rangelands.

Table 3-20 summarizes the acreages and permitted grazing use on the four allotments with acquired public lands. The Empire-Cienega and the Empirita allotments consist entirely of federal and state-leased lands. (The operators own no deeded lands in these allotments.) The operators in the Vera Earl and Rose Tree allotments own private lands in their allotments and use these private lands in common with the leased grazing lands. On the four allotments BLM permits a total grazing use of 9,984 animal unit months (AUMs) of forage, which equates to 832 cattle on a yearlong basis (CYLs).

Only the Empire-Cienega and Empirita allotments have grazing management plans. BLM and NRCS completed an ecological site inventory for the Empire-Cienega allotment in 1995 and BLM and the livestock operators developed an interim grazing plan in 1995 (BLM 1995) (See also Appendix 2, Summary of Empire-Cienega Interim Grazing Plan). The Parsons Company Inc., the Natural Resources Conservation Service, the Arizona State Land Department, and BLM cooperatively developed a grazing management plan for the Empirita Ranch in 1994 (NRCS 1994) and completed an ecological site inventory of the rangelands (See Appendix 3, Ecological Site Inventories). Both of these plans did the following:

- Prescribed how the livestock grazing operation would be conducted to sustain the resources.
- Established permanent vegetation monitoring.
- Determined needed range improvements.

BLM completed a biological evaluation of the Empire-Cienega interim grazing plan, consulted with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act, and received a biological opinion from USFWS (No. 2-21-95-F-177). BLM is now implementing the actions in the biological opinion (See Appendix 2, Summary of Biological Opinions). Before this consultation, BLM had consulted with USFWS (1990) on the first riparian fences built along Cienega Creek and received a biological opinion (No. 2-21-90-I-150). USFWS also issued another biological opinion (No. 2-21-96-F-160) as a result of the Section 7 consultation on the livestock grazing program administered by BLM's Tucson Field Office under the Safford District Resource Management Plan. This RMP consultation covered the four allotments with acquired lands as well as the Rain Valley allotment (See Appendix 2, Summary of Biological Opinions).

OUTDOOR RECREATION

Southern Arizona is heavily marketed by the tourism industry, especially for recreation involving open space, natural areas, and old west themes. The proximity of the planning area to Tucson and smaller surrounding communities attracts many visitors traveling among several southeast Arizona tourist attractions.

The planning area provides a setting for a wide variety of recreation, mostly for dispersed activities. But the historic ranch is a focal point

Map 3-8
Grazing Allotments

Table 3-20
Grazing Allotments, Empire-Cienega Integrated Management Plan

Allotment	Total Acres	Total Acres Grazed	Total Cows	BLM Acres Grazed[1]	BLM Cows	ASLD[3] Acres	ASLD Cows	Private Acres	Private Cows
Empire-Cienega (6090)	74,146	73,696	1,500	36,025 (659 Not Grazed)[2]	704	37,462	796	0	0
Empirita (6210)	24,988	23,908	337	440 (1,080 Not Allocated)	9	23,468	328	0	0
Rose Tree (6043)	8,869	8,869	200	3,950	92	3,719	24	1,200	84
Vera Earl (6129)	1,440	1,440	27	1,440	27	0	0	N/A	N/A
TOTAL:	**109,443**	**107,913**	**2,064**	**41,855**	**832**	**64,649**	**1,148**	**1,200**	**84**

[1] An additional 160 acres of public land are grazed on the Rain Valley allotment.
[2] The planning area has 7,360 acres of ungrazed public lands, 659 acres of which are within livestock exclosures on the Empire-Cienega allotment and 1,080 acres of which are not allocated to grazing within the Empirita allotment. In addition, 2,480 acres of acquired and original public domain land in the Empire Mountains are not allocated to grazing, and 3,141 acres of public land in the Appleton-Whittell ACEC are closed to grazing.
[3] Arizona State Land Department.

for many visitors. Activities vary from driving off-highway vehicles to camping, bird watching, studying nature and history, hang gliding, picnicking, horseback riding, hunting, and training bird dogs. Not all of these activities require developed facilities, but visitors often use the grazing permittee's improvements such as corrals and water sources.

Areas of concentrated use include Oak Tree Canyon, the old Agricultural Fields near the Cienega Ranch, the Maternity Well Site, and the old Air Strip. Although the planning area offers high-quality experiences for most recreation activities, the quality of experiences and resources can be diminished by high numbers of visitors during hunting seasons and by those who do not use minimum impact camping techniques.

Generally, visitors drive on existing roads and camp in dispersed areas. Brochures and entrance signs encourage visitors to camp at existing primitive campsites and not to create new campsites or roads. But visitors create many illegal wildcat roads and primitive campsites every year. Most visitors camp or park in undeveloped or nondesignated areas at sites developed by social camping (where campers use a site because they see evidence of prior camping). Many of these campsites have degraded surrounding areas. The total disturbed surface in the planning area from campsites is estimated to be 10 acres. An estimated 100-150 social campsites and fire rings dot the planning area.

Oak Tree Canyon seems especially affected because of its desired attributes such as its many Emory oaks, its cooler climate, and its easy access by two-wheel drive vehicle. Visitors often establish their campsites and fire rings directly under the oaks. As a result, extreme campfire heat reaches into the branches and vehicles compact the soil so that little rain water can seep to the roots.

The planning area's two developed campsites have fire grills, tables, or both. One site is at Empire Gulch, one mile north of headquarters. This site may have been intended for picnicking or day use, but visitors often use it for camping and human waste is contaminating the gulch. The other site is under some old cottonwood trees just southeast of the Agricultural Fields, accessed near North Canyon. Because branches from these decadent trees weigh several hundreds to thousands of pounds and can easily drop off, they are a hazard to anyone camping beneath them.

Unofficially, one can obtain non-potable water at areas such as the Empire Ranch headquarters, Maternity Well, the well between Empire Gulch and the abandoned airstrip, and stock tanks. Often the public will ask the grazing permittee for permission to use these wells and tanks. BLM asks special recreation permit holders to haul in their own drinking water from outside the planning area.

Table 3-21
Recreation Visitors to the Empire-Cienega Planning Area, 1993-1998

	% of Visitor Days Engaged in Activity by Season				
Activity	**Winter**	**Spring**	**Summer**	**Fall**	**Overall**
Backcountry Touring and Sightseeing	34.9	38.8	19.7	32.9	32.5
Picnicking	8.7	9.0	17.7	5.0	9.8
Camping Near Vehicle	3.0	9.8	3.4	11.9	7.7
Camping Away from Vehicle	5.0	0.3	0.1	0.2	1.1
4-Wheel/All-Terrain Vehicles	2.7	2.1	2.8	3.2	2.7
Motorcycling	0.7	1.1	1.8	1.1	1.2
Bicycling	3.2	2.4	1.3	3.9	2.7
Hunting	2.9	2.1	10.1	11.7	6.5
Watching Wildlife	13.5	14.9	11.1	12.8	13.2
Hiking	2.9	3.0	5.4	1.5	3.1
Viewing Cultural Sites	0.7	--	1.1	0.3	0.4
Field Dog Activities	1.5	0.8	1.1	0.7	0.9
Other	20.3	15.7	24.4	14.8	18.2
TOTAL:	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
TOTAL VISITOR DAYS:	**1,203**	**2,256**	**1,461**	**1,707**	**6,627**

Throughout the planning area are popular hunting campsites which remain in traditional use. Most hunters seek deer, javelina, coyote, and small game such as rabbit and quail. The Arizona Game and Fish Department issues a few pronghorn hunting permits each year.

The planning area has become increasingly popular for commercial recreation and organized events that require special recreation permits. In the past 10 years, BLM has issued permits for hiking, bicycling, equestrian outfitters, orienteering, and competitive bird dog events. Other activities that are known to be occurring but for which BLM has not issued special recreation permits include bird watching tours, stargazing, hang gliding, para-gliding, ultra light flying, paint-ball battles, and family reunions. Most of these activities are based at three sites: Maternity Well (50%), the abandoned Agricultural Fields (30%), and the pronghorn release site (10%). The remaining 10% of use occurs at other sites.

Table 3-21 presents the percentages of visitors engaged in a variety of recreation activities in the planning area between 1993 and 1998. These percentages are calculated from sign-in register sheets collected at the entrance off Highway 82 and at the kiosk on the main road one mile east of Highway 83. Because not every visitor signs in, these numbers do not represent a concise or accurate account of recreation use but rather a sampling. The activities in the "Other" category in Table 3-21 include hang gliding, para-gliding, and horseback riding.

PUBLIC EDUCATION AND INTERPRETATION

General information on the planning area may be obtained from BLM. Some information is also presented in cooperatively funded maps and brochures. Supplies of brochures at visitor centers vary throughout the year. The current trend is to scan all brochures and maps onto computers, allowing information printed from computer web sites to replace traditional printed material. The public is increasingly accessing these sites. The public may also obtain off-highway vehicle maps and general guides by mail or pick up copies at the BLM office. Brochures or maps are occasionally available at the historic Vail ranch house or given out by volunteers. The main information source for most planning area visitors consists of displays on bulletin boards at the main entrances from Highways 83 and 82.

The public generates significant amounts of information on the planning area through internet sites, guide books, and other publications. We do not know the exact amount, accuracy, or contents and whether this information supports management objectives.

BLM presents informal and formal interpretive/educational programs 1 to 10 times a year for schools, universities, and professional and other groups. But BLM receives an average of up to 20 requests a year for formal presentations by resource specialists. Often the requesting parties are professional organizations conducting seminars, field trips, or large conferences. Many informal requests for presentations do not give much notice and BLM specialists may deliver formal or informal presentations depending on the time they have for preparation.

One way that BLM is dealing with increasing requests for tours by experts is referring them to the outfitters with permits to operate in the planning area. But outfitters often ask BLM staff to participate because they do not feel qualified to talk to the public about the area.

ACCESS AND OFF-HIGHWAY VEHICLE MANAGEMENT

The planning area's most used and publicized access point is the Empire Ranch Road, off of Highway 83 near mile marker 40. The second

most used access is South Road from Highway 82, four miles east of Sonoita. In addition, the ~~U.S. Forest Service has developed an off-highway vehicle (OHV) staging~~ area at Highway 83 and Oak Tree Canyon~~. This staging area~~ allows access between Forest Service, State Trust Land, and BLM-managed areas for hikers, horseback riders, all-terrain vehicles, and motorcycles only. The culvert and barricades under the highway exclude cars and trucks. This access is published in OHV maps and guides distributed by Arizona State Parks.

The public uses many other access points to enter public lands in the planning area. These access points appear on a wide range of maps. BLM has not secured legal access for any of the other access points that cross private or State Trust Lands. These access points, therefore, may not be open to the public over the long term.

Under interim management guidance for the public lands in the planning area, motorized vehicles are limited to designated roads and trails (BLM 1988). Although most existing roads have remained open to public use, some roads have been closed or restricted for resource or safety reasons. The designated road system was partially implemented in 1999 through publication of the Empire-Cienega Access Guide map and implementation of an associated road numbering system.

SPECIAL DESIGNATION AREAS

WILD AND SCENIC RIVERS

BLM has determined that two segments of Cienega Creek within the planning area are eligible for further study in the Wild and Scenic River evaluation process because Cienega Creek is free flowing and has outstandingly remarkable essential habitat for the federally endangered Gila topminnow (Safford District Resource Management Plan Amendment) (BLM 1993). The Final Arizona Statewide Wild and Scenic Rivers Study Report/Record of Decision (February 1997) determined that the two segments of Cienega Creek were suitable to be recommended to Congress for inclusion in the National Wild and Scenic Rivers System. Both river segments have been tentatively classified as scenic.

The Cienega Creek Wild and Scenic River Study Area contains 10.5 river miles of which 10 are managed by BLM and 0.5 miles crosses State Trust Land (Map 3-9). The study area extends out 0.25 miles from the mean annual high water mark shoreline on either side of Cienega Creek. The 3,360-acre study area includes 3,200 acres of BLM-administered land and 160 acres of State Trust Land. The 10.5 miles of river in the study area include two separated segments of Cienega Creek totaling 8.5 miles and 1-mile segments each of Mattie Canyon and Empire Gulch–tributaries to Cienega Creek.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

BLM has designated one area of critical environmental concern (ACEC) within the planning area. The Appleton-Whittell ACEC includes 3,141 acres of public land. It is managed under a cooperative management agreement with the National Audubon Society (signed in 1986) as part of the Appleton-Whittell Biological Research Sanctuary (Research Ranch) (Map 3-9). The objectives for the area include the continuation of ongoing research, encouragement of future research, and protection of the land and its ecological communities from disturbance. The ACEC provides a unique outdoor laboratory for studying the effects of nongrazing on a desert grassland and ecological relationships within a

nongrazed grassland. Within the ACEC, BLM has done the following:

- Limited motorized vehicles to designated roads and trails.
- Prohibited land use actions except as authorized by the Research Ranch.
- Kept the area closed to mineral location, leasing, and sales.

SOCIAL AND ECONOMIC CONCERNS

The Empire-Cienega Planning Area is surrounded by three counties and several communities. Social and economic issues brought forth during scoping include the following:

- How do our actions reflect on economics of the region, both private and public?
- Growth
- Attitudes (i.e., expectations, balance, respect, communication, rural versus urban, education).

The planning area itself is large. Although its lands are in Pima and Santa Cruz counties, its management may affect communities in other counties.

QUALITY/WAY OF LIFE

Residents of Sonoita have expressed a desire to maintain their quality of life--their current rural lifestyle. But the quality-of-life issue is highly subjective. Quality-of-life issues involved the following growth concerns:

- Impacts of future traffic between Sonoita and Tucson.
- Possible increase in commuters and the concern that growth would bring internal and external impacts upon public/forest/private lands.
- How these impacts would affect the area's rural lifestyle.

POPULATION AND DEMOGRAPHICS

Communities near the planning area are in three counties: Vail in Pima County, Patagonia and Elgin in Santa Cruz County, and Benson in Cochise County. These communities range from 8 to 20 miles from the planning area. The closest communities are Sonoita, Elgin, Patagonia, and Vail. The largest nearby community is Benson. These communities vary in population from 417 in Elgin to more than 6,000 in Benson. While Benson's population is 61% urban, the other communities are mostly rural (Bureau of the Census 1996).

Projections for the year 2000 estimate a 10.7% population increase for Cochise County. Santa Cruz County is projected to increase by 16.2%, and Pima County will have the largest increase in population--18% (ADES 1998).

As a percentage of the communities' county population, Hispanics comprise the single largest ethnic minority group. The largest populations are in Vail with 26.9% and Patagonia with 35.8%. Native Americans and other minority groups make up less than 5% of the population. in all of the communities (Bureau of the Census 1996).

Out of the 15 counties in Arizona, Santa Cruz is ranked fifth in the state in the number of people in poverty. Cochise is ranked eighth and Pima eleventh (Bureau of Census 1993a).

Map 3-9
Alternative 1 - Current Management Special Designation Areas

LOCAL AND REGIONAL ECONOMY

The main economic activities in Santa Cruz County are concentrated in Nogales, 18 miles south of Patagonia (Arizona Department of Commerce 1993). All of Santa Cruz County is an Enterprise Zone. An Enterprise Zone is a Presidential Empowerment Initiative that seeks to empower communities by supporting local plans that coordinate economic, physical, environmental, community, and human development. The county's main industries include tourism, international trade, manufacturing, and services. Patagonia is the second largest community in Santa Cruz County, but its population is only 1,664 whereas Nogales has nearly 8,000 residents.

Pima County is the second largest Arizona county in population and area. Major county industries include copper mining, manufacturing, tourism, and education. Vail is predominately rural. Its residents are either self-employed or employed by local, state, or federal governments (Arizona Department of Commerce 1994).

Farming, ranching, tourism, and the military are the major industries in Cochise County. Sierra Vista is the county's largest city. Benson, the second largest city, lies along several trade routes: Interstate Highway 10, U.S. Highway 90, and the main line of the Southern Pacific Railroad. Nearby mining and manufacturing are the area's major employers.

EMPLOYMENT

The statewide unemployment rate in Arizona is 4.7%. Countywide unemployment varies greatly. Pima County has the lowest unemployment rate at 3.4%. Santa Cruz County has the highest unemployment rate at 17.9%. Twenty-two percent of the county's unemployment is in the Nogales area. The unemployment rate in Cochise County is 10.0%. The unemployment rates for both Santa Cruz and Cochise counties exceed the statewide unemployment rate (ADES 1998).

ENVIRONMENTAL JUSTICE

On February 11, 1994, Executive Order 12898 (Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations) was published in the *Federal Register* (59 FR 7629). The order requires federal agencies to recognize and address disproportionately high and adverse human health or environmental effects to its program's policies and activities on minority and low-income populations. The Environmental Protection Agency has defined environmental justice as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

BLM has involved the public by inviting it to participate in local scoping meetings at the beginning of the EIS process. Other public meetings of the Sonoita Valley Planning Partnership have invited the public to sit in and contribute their issues and concerns about the planning area as well as actively participate in developing the management plan (See Chapter 5).